



# **CITY OF ELOY WATER SYSTEM DEVELOPMENT STANDARDS**

**FEBRUARY 2007**

**CITY OF ELOY PUBLIC WORKS DEPARTMENT  
DESIGN STANDARDS MANUAL OVERVIEW**

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**CITY OF ELOY PUBLIC WORKS DEPARTMENT  
SECTION 1  
DESIGN STANDARDS MANUAL OVERVIEW**

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**1.0 DESIGN STANDARDS MANUAL OVERVIEW**

**1.1 Introduction**

**1.1.1 Purpose of Manual**

For public water projects that will become a part of the City of Eloy Water system, the purpose of this manual is:

- Present the requirements to obtain approval from the City of Eloy for the design of public water project plans and specifications
- Provide uniform standards to those who are involved in the planning, design, and construction of public water system facilities,
- Ensure the project is designed and approved while complying with, statutes, codes, ordinances and any applicable regulations.

A water plan approval process flow-chart is provided as Exhibit 1-1.

**1.1.2 Authority for Manual**

The establishment of a design standards manual was authorized by the City of Eloy pursuant to the authority granted in:

**A. A.R.S. 9-499.01, Powers of Charter Cities**

"Charter cities ... shall be vested with all the powers of incorporated towns ... in addition to all powers vested in them pursuant to their respective charters, or other provisions of law relating to cities."

**B. A.R.S. 9-511, Power To Engage In Business Of Public Nature**

1. "A municipal corporation may engage in any enterprise and may construct, purchase, acquire, own and maintain within or without its corporate limits any such enterprise.
2. A municipal corporation may also purchase, acquire and own real property for sites and rights-of-way for the location thereon of waterworks pipelines for the transportation of water
3. The municipality may exercise the right of eminent domain either within or without its corporate limits and may establish, lay and operate a plant, or pipeline upon any land or right-of-way taken thereunder.

**C. Eloy City Code, Chapter 19, Water and Sewers**

*Management of Water System:* The council of the City of Eloy, hereinafter referred to as "City," shall have the immediate control and management of all things pertaining to the City water system and shall perform, or cause to be performed, all acts that may be necessary for the prudent, efficient and economical management and protection of said water system. The Council shall have the power to prescribe such other and further rates, rules and regulations as it may deem necessary, and the power to amend, repeal, modify or alter these rules and regulations or any portion thereof at any time by resolution.

**CITY OF ELOY PUBLIC WORKS DEPARTMENT  
SECTIONS 1  
DESIGN STANDARDS MANUAL OVERVIEW**

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**1.1.3 Revisions**

This manual may be revised periodically. Proposed revisions will be made available at the office of the Public Works Department 60 days prior to implementation unless the revision is required for compliance with Federal, State, or City laws, ordinances or codes.

**1.1.4 Interpretation of the Manual**

This manual is comprised of written engineering standards, references to established standards and details of other organizations and agencies, and standards and specifications established by the City of Eloy Public Works Department. The City of Eloy Engineer (City Engineer), whose interpretation shall be binding and controlling in its application, shall make the interpretation of any section or of differences between sections.

Any deviations from the Standards in this manual as determined by the City Engineer shall require a technical appeal through the standard technical appeal process.

**1.1.5 Standard Specifications and Details**

The standard details and specifications that are referenced in this manual and serve as the basis for developer funded water systems improvements include the following:

*Uniform Standard Specifications for Public Works Improvements* published and distributed by the Maricopa Association of Governments. These specifications are herein referred to as MAG Specifications. These specifications are updated periodically and are available through the Maricopa Association of Governments office in Phoenix as well as online at [www.mag.maricopa.gov](http://www.mag.maricopa.gov).

*Uniform Standard Details for Public Works Improvements* published and distributed by the Maricopa Association of Governments. These specifications are herein referred to as MAG Standard Details. These details are updated periodically and are available through the Maricopa Association of Governments office in Phoenix as well as online at [www.mag.maricopa.gov](http://www.mag.maricopa.gov)

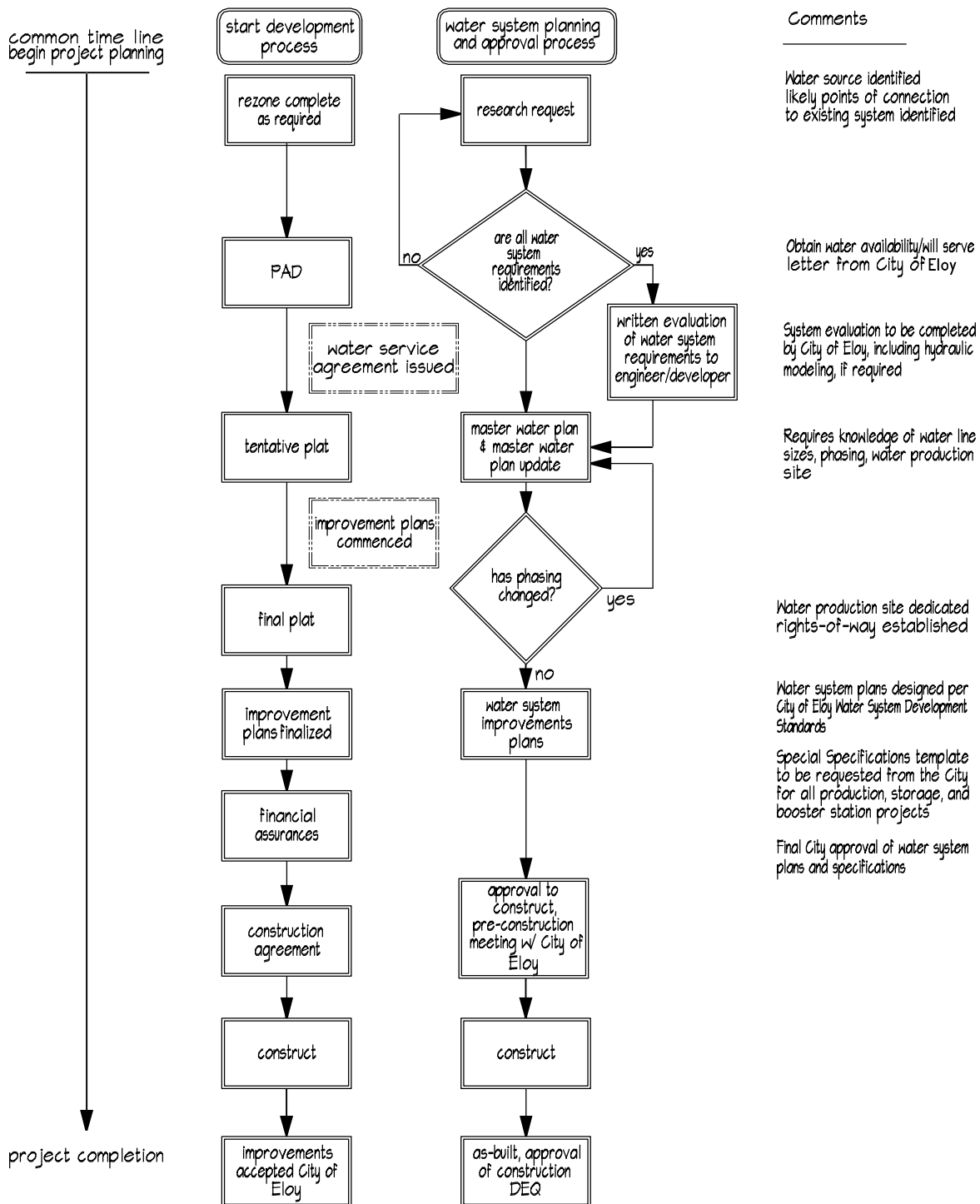
*The City of Eloy Water System Development Standards*, which serve to supplement the existing MAG standards and details. These specifications are updated periodically and are available at the office of the City of Eloy Public Works Department.

**1.2 Basic Requirements Overview**

**1.2.1 State of Arizona Requirements**

Pursuant to the AAC R18-5-502 (A), recodified 1/30/04, a water system that is designed consistent with the criteria in ADEQ Engineering Bulletin No. 10, "Guidelines for the Construction of Water Systems," May 1978, shall be considered to have been designed using good engineering practices.

ADEQ Engineering Bulletin No. 10 provides guidance and minimum design criteria for the modification and construction of water systems. It is intended for use in the tasks of water system planning, design, plan development, specification writing, review and construction.



ISSUED:

MARCH 2007

REVISED:

## WATER PLAN APPROVAL PROCESS EXHIBIT 1-1

**CITY OF ELOY, PUBLIC WORKS DEPARTMENT  
SECTION 2  
WATER PLAN ACCEPTANCE REQUIREMENTS**

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**2.0 WATER PLAN ACCEPTANCE REQUIREMENTS**

**2.1 General**

**2.1.1 Purpose**

This section describes the requirements to obtain acceptance from the City of Eloy for the design of public water projects. The following paragraph is intended to clarify the use of the terms accept, accepted, acceptance, or any other derivative:

The action taken on these proposed projects submitted for review is to “accept” the projects—denoting that the project meets the requirements of the City of Eloy, and may be forwarded to ADEQ for “approval” consistent with State statutes and regulations.

**2.1.2 Applicability**

The water project acceptance requirements listed herein are applicable to public water projects that will become an integral part of the City of Eloy Water Utility system.

Typical water projects that are governed by this standard include:

- Water line extensions
- Water storage facilities
- Water pumping stations
- Other water facilities as may be required by the City of Eloy to ensure compliance with the objectives stated in this Manual, and
- Modifications to existing water system infrastructure

**A. The City of Eloy Approval**

All water system modifications, augmentations, or expansions require City of Eloy approval.

**B. Approval to Construct Requirements of ADEQ**

All public water projects must meet the Approval to Construct requirements of ADEQ before the initiation of construction. Refer to ARS 49-353(A)(2) and AAC R18-5-505, Approval to Construct, for current requirements.

**C. Exemptions from Plan Review Requirements of ADEQ**

Exemptions from the plan review requirements of ADEQ, including the requirements for the Approval to Construct and the Approval of Construction, pursuant to ARS 49-353 (A)(2)(e), are based on the drinking water project cost including design cost. This exemption will not apply to most developer funded projects.

**CITY OF ELOY, PUBLIC WORKS DEPARTMENT  
SECTION 2  
WATER PLAN ACCEPTANCE REQUIREMENTS**

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**2.2 Submittal, Review and Acceptance Process Requirements**

The submittal, review and acceptance process for water projects includes:

- Assured Water Supply Letter
- Water Master Plan Requirements
- Design Plan Review and Water Plan Acceptance
- Water Plan Revisions
- Plan Finalization
- Fees

**2.2.1 Assured Water Supply Letter**

Application for an Assured Water Supply Letter is required for public water projects that meet any one of the following condition(s):

- Water plans are a component of improvement plans for a platted subdivision for a master block plat
- Cost estimates, including design, greater than \$12,500,
- Project lies outside of current Eloy City limits.

Application for an Assured Water Supply Letter is made through the City of Eloy Public Works Department and should include:

- an 8.5"x11" drawing delineating the area to be served
- township-range-section
- number and size of services, if known

Issuance of an Assured Water Supply letter should not be construed as the City of Eloy's acceptance of water plan or water service application.

Water Assurance Letters are valid for a period of one year from issuance.

**2.2.2 Water Master Plan Requirements**

Water master plans are required for all public water projects.

This subsection contains the following major topics:

- Research Request Letter
- Overall Water Master Plan
- Water Master Plan

**A. Research Request Letter**

A Research Request Letter is to be submitted for all proposed developments in the City's water service area. The letter presents preliminary information on the proposed development and allows the City to identify (in general terms) any required upgrades to the existing water system or new infrastructure required to serve the development. It also allows the City to assess how the project will fit into the City's overall Master Water Plan early in the planning process.

**CITY OF ELOY, PUBLIC WORKS DEPARTMENT**  
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1. Research Request Submittals

Submittals required for the City of Eloy to perform a Research Water Master Plan Review include:

- a) A copy of a valid Assured Water Supply Letter.
- b) A Research Request Letter containing:
  - A drawing showing the project boundary, adjacent streets, and any available planning information including block or lot layouts, proposed phasing, traffic circulation, existing wells, or any other information that will assist the City in assessing the needs of the project.
  - Anticipated timing of the project

2. Research Request Response

The City will issue a response letter outlining in general terms the water system improvements that will be required as part of project development. These improvements may include offsite water main extensions, new production facilities, existing facility upgrades, and new and on-site and off-site transmission mains and reservoir fill lines. The research review will also identify issues in regard to protected mains and facilities, required easements, engineering conflicts. The information gathered in the research phase will assist in the preparation and minimize review and comment period of the Master Water. Research completed by the City may include hydraulic modeling to examine the effect of the proposed development on the existing water system.

3. Expiration

Information provided by the City in the Research Request Response is valid for a period of one year after issuance.

4. Research Request Fee

A review fee will be assessed at the time of submittal according to the review fee schedule under the Master Fee Schedule.

B. Water Master Plan

1. Purpose

The purpose of the Master Plan is to assure the proposed water system design complies with the policies, standards, and overall system Master Plan as adopted by the City of Eloy. The master plan review will use hydraulic modeling to determine if the existing and proposed system (both onsite and offsite) is adequate to meet maximum maximum day water demand plus fire-flow conditions.

2. Submittal Documents

See the Master Water Plan and Hydraulic Review Checklist presented as Exhibit 2-1 for a summary of submittal requirements.

3. Review Process

The proposed Water Master Plan will be forwarded to the primary reviewer to be reviewed and returned to the Design Engineer for revision, if needed. Revisions shall be resubmitted in a timely manner. The process shall continue until the plan meets all applicable requirements.

**CITY OF ELOY, PUBLIC WORKS DEPARTMENT  
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Once the Water Master Plan is accepted, the Design Engineer shall be informed in writing. Final acceptance of the Master Water Plan shall require plan review and signature by the local Fire Marshall.

4. Expiration

The approved Master Water Plan shall remain valid for a period of one calendar year from date of approval. At that time the Master Water Plan shall be cancelled and the City of Eloy shall be released from any commitments relating to the allocation of resources to the project unless a request for extension is submitted and approved prior to the expiration date. Approval of the extension request is at the discretion of the City Engineer.

5. Master Plan Review Fee

A master plan review fee will be assessed according to the number of sheets submitted and per the review fee schedule provided in the Master Fee Schedule.

C. Overall Water Master Plan

Development projects that are divided into "Phases" require an overall Water Master Plan. The overall plan must examine the "stand alone" capability of each phase until the last phase is completed. Each phase must meet minimum pressure and storage requirements set by ADEQ.

Once the overall water plan is approved, an acceptance letter will be issued. Acceptance of the overall Water Master Plan is a "conceptual acceptance" and minor changes may be shown in subsequent phase specific master plans.

1. Overall Water Master Plan Submittals

See the Master Water Plan and Hydraulic Review Checklist presented as Exhibit 2-1 for a summary of submittal requirements.

Each phase of development as shown in the the overall Water Master Plan will require an individual Water Master Plan that is submitted to the City Engineer for review and approval. If the scope of particular project phase no longer matches the overall Water Master Plan or fire-flow requirements change, then the consultant/engineer will be required to resubmit that phase of the project for a new review. If the City Engineer reviewer determines a phased portion of the overall Water Master Plan has changed considerably from the approved document, a revised submittal reflecting the changes may be required.

2.2.3 Design Plan Review and Water Plan Acceptance

1. All public water project designs must be reviewed and accepted by the City of Eloy prior to construction. The Applicant shall be fully responsible for all aspects of the construction drawings. Review and acceptance by the City of Eloy shall in no way relieve the Applicant of this responsibility.
2. After a public water project has received master plan acceptance, the formal water plans will be reviewed for system design, drafting and sheet format consistent with the requirements of this manual.
3. Plans shall be submitted to City Engineer.

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4. Review fees shall be paid at the time of plan submittal. The review fee schedule is included in rates, fees, and charges.
5. All submittals shall conform to requirements set forth in this manual.
6. A water plan submitted for the first design review must be accompanied by a completed Water Plan Checklist – First Review, presented as Exhibit 2-2. Submittal requirements for the water plan are identified in the first section of the checklist.
7. Plans shall be resubmitted until compliance is achieved.
8. Plans are reviewed on a first-come, first-served basis.
9. An "Agreement for Construction of Water Facilities Under Private Contract" (hereinafter "Construction Agreement") must be executed prior to construction. The document will be prepared by the Public Works Department and will be forwarded to the Owner/Developer as early in the design review process as possible. An executed Construction Agreement becomes a commitment by the City of Eloy to provide water service and defines all requirements for construction, liability, dedication of facilities, protected mains, and any other special conditions. In the event that a water plan is cancelled, the Construction Agreement shall also be cancelled. The Agreement is not a commitment to provide water service until it is signed by the City of Eloy.
10. All required signatures, must be obtained prior to approval by the City of Eloy.
11. All accepted water plan originals will be retained by the City of Eloy and become the City of Eloy property. Plans are valid for one year from the date of acceptance. Plans that exceed the deadline without acquiring a "Notice to Proceed" shall be cancelled and will require resubmittal and approval.

**2.2.4 Water Plan Revisions**

1. Water plans must, at all times, reflect the actual conditions and scope of the project. If the design concept, plat, or any other pertinent information changes after plan acceptance and prior to finalization, it will be the responsibility of the Applicant to promptly revise the original construction drawings.
2. An accepted plan that requires alteration must be formally revised. Construction of the proposed revision may not commence prior to review and acceptance of the proposed revision.
3. The Applicant shall submit to the Public Works Department a full-size copy of the accepted water plan with the proposed revision shown in red or any other contrasting color or delineated with a revision cloud. The submittal shall include any appropriate documents pertinent to the revision, such as a revised plat, electric plan, easement description, or cost estimate.
4. The revision fee shall be paid at the time of submittal. The fee schedule is included in fees, rates, and charges.
5. The design reviewer will add any applicable comments to the submitted copy of the revised water plan. Depending upon the scope of the revision, the Master Plan reviewer may add additional comments or requirements.
6. The mark-up of the proposed revision will be returned to the Applicant along with the City of Eloy's signed original of the accepted water plan.
7. The Applicant shall revise the original water plan in accordance with the comments on the mark-up of the proposed revision.

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8. If any aspect of the fire protection system has been altered, the revised original must be reviewed and accepted by the appropriate fire authority prior to submitting the revised original to the City of Eloy.
9. The applicant shall submit the revised original, a full-size copy of the revised original, and the mark-up of the proposed revision to the design reviewer for review and acceptance.
10. Upon acceptance the City of Eloy will retain the revised original. Digital files of the water system layout are also required at this time. Files are to be AutoCAD release 2004 or higher.

**2.2.5 Fees**

Plan review fees are established at the time of plan submittal shall be due and payable prior to initial review by the City.

**2.3 Approval Requirements – Arizona Dept. of Environmental Quality**

All project plans are to be submitted to ADEQ for acceptance prior to construction. Documentation of acceptance by ADEQ shall be kept on the project site during all phases of construction. Generally, the project review and approval requirements of ADEQ are described in AAC R18-5-505, Approval to Construct, recodified January 30, 2004. This rule is required by ARS 49-353.

**2.4 Design Changes to Approved Projects**

**2.4.1 Approval of Design Changes**

All design changes to a previously approved project design must comply with Section 2.2.4 of this Manual and will require approval by the City Engineer. This includes:

- Design changes before going to bid, after final design approval,
- Invitation for bid amendments, during the bidding process, and
- Design modifications during construction.

**A. Cover Sheet Revisions**

Make revisions to revision block on cover sheet (or sheet index map) as follows:

1. Revision number
2. Revision date
3. Person designing revision
4. Revised sheets in "revision" column
5. Person checking revision
6. Seal and sign cover sheet

**B. Revising Affected Sheets**

Make revisions to the affected sheets as follows:

1. Retrieve original plan sheets from the Public Works Department
2. "X" out deleted items
3. Draw a "cloud" around revised or added items

**CITY OF ELOY, PUBLIC WORKS DEPARTMENT  
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4. Put the revision number in triangle adjacent to each revisions
5. Fill in the revision block on each revised sheet
6. Seal and sign revision on each revised sheet

**2.4.2 ADEQ Approval**

**A. Material Design Change Determination**

Pursuant to AAC R18-5-506, Compliance with Approved Plans, any material change in the approved design will require approval by ADEQ if the change will affect:

- Water quality
- Capacity
- Flow
- Sanitary features, or
- Performance

Revisions not affecting water quality, capacity, flow, sanitary features, or performance, may be permitted during construction without further ADEQ approval if record drawings document these changes, prepared by a professional engineer registered in Arizona.

**B. Submittal and Review of Material Design Change**

When there is a material change in the approved design, the revised plans and specifications and a written statement of the reasons for such change shall be submitted to ADEQ for review:

**C. Approval of Material Design Change**

Approval shall be obtained in writing from ADEQ before the work affected by the change is undertaken.

# CITY OF ELOY PUBLIC WORKS DEPARTMENT MASTER WATER PLAN AND HYDRAULIC REVIEW CHECKLIST

Project Name: \_\_\_\_\_ Sec. \_\_\_\_\_, T \_\_\_\_\_S, R \_\_\_\_\_ E

Complied   N/A

## ITEMS TO BE ADDRESSED ON PLAN

- ☐ One copy of the proposed Master Water Plan
- ☐ Fire Department signature and review comments for hydrant locations and required flow
- ☐ Existing contours and final grades.
- ☐ North Arrow, scale and location map.
- ☐ Project name and Owner/Developer name, address and telephone number
- ☐ Project boundary, lot lines, and acreage of property.
- ☐ Number of units to be served and location and size of meters.
- ☐ Length and size of proposed mains (label each length between fittings)
- ☐ ☐ Show all existing adjacent water mains, stub-outs and proposed points-of-connection to the existing system; label pipe sizes, material, plan number and pressure zone.
- ☐ ☐ Label existing/proposed "protected mains."
- ☐ Show locations of all existing and proposed well within and adjacent to the property and label wells (where applicable) with the ADWR registry number and well use code.
- ☐ ☐ Show and label project phase lines if future phasing is anticipated
- ☐ Show and label existing and future right-of-way, common area(s), easements, washes and other relevant features that could significantly impact water system design.
- ☐ ☐ Show and label all proposed production, booster, and storage facilities and include proposed pumping capacity and storage volumes.

## ADDITIONAL COMMERCIAL REQUIREMENTS

- ☐ Number and size of Fire Service(s), flow requirements for each sprinkler system \_\_\_\_\_ gpm
- ☐ \_\_\_\_\_ gpm
- ☐ \_\_\_\_\_ gpm
- ☐ Estimate Peak Hour demands or fixture unit demands for each water service \_\_\_\_\_ gpm
- ☐ \_\_\_\_\_ gpm
- ☐ \_\_\_\_\_ gpm



*City of Eloy Public Works Department*

**OWNER/DEVELOPER**

NAME: \_\_\_\_\_

ADDRESS: \_\_\_\_\_

\_\_\_\_\_

PHONE: \_\_\_\_\_

CONTACT: \_\_\_\_\_

**DESIGN FIRM/CONSULTANT**

NAME: \_\_\_\_\_

ADDRESS: \_\_\_\_\_

\_\_\_\_\_

PHONE: \_\_\_\_\_

CONTACT: \_\_\_\_\_

\_\_\_\_\_  
Designer's Signature

\_\_\_\_\_  
Date



*City of Eloy Public Works Department*

**Exhibit 2-1**

**CITY OF ELOY PUBLIC WORKS DEPARTMENT  
WATER IMPROVEMENT PLAN CHECKLIST – FIRST REVIEW**

Project Name: \_\_\_\_\_ Sec. \_\_\_\_\_, T \_\_\_\_S, R \_\_\_\_ E

**Complied**   **N/A**

**ITEMS TO BE SUBMITTED WITH PLAN**

- |                          |                          |  |
|--------------------------|--------------------------|--|
| <input type="checkbox"/> | <input type="checkbox"/> | A completed and signed copy of this checklist with written statement explaining any non-compliance                         |
| <input type="checkbox"/> | <input type="checkbox"/> | Current copy of the water improvement plan with engineer's stamp and signature   |
| <input type="checkbox"/> | <input type="checkbox"/> | Most final form of the subdivision plat, recorded survey, or recorded legal description reflecting current property lines. |
| <input type="checkbox"/> | <input type="checkbox"/> | Improvement plans or site development plan   |
| <input type="checkbox"/> | <input type="checkbox"/> | Itemized cost estimate with plan name referenced.  |
| <input type="checkbox"/> | <input type="checkbox"/> | Special specifications, if required  |
| <input type="checkbox"/> | <input type="checkbox"/> | Project phasing: Separate water plans for each phase   |
| <input type="checkbox"/> | <input type="checkbox"/> | New legal descriptions, labeled current ownership and/or recorded legal descriptions for existing easements.               |
| <input type="checkbox"/> | <input type="checkbox"/> | Approved Master Water Plan   |

**Complied**   **N/A**

**ITEMS TO BE ADDRESSED ON PLAN**

**A. GENERAL**

- |                          |   |
|--------------------------|---|
| <input type="checkbox"/> | 24"x36" sheets in City of Eloy format with standard title and City of Eloy logo   |
| <input type="checkbox"/> | All drawings per City of Eloy Water Plan Drafting Standards   |
| <input type="checkbox"/> | Design to conform to City of Eloy and ADEQ Bulletin requirements  |
| <input type="checkbox"/> | Water main sizes and location conform to the City's Master Water Plan and the approved Master Water Plan for the subdivision or commercial development. |

**B. COVER SHEET**

- |                          |   |
|--------------------------|---|
| <input type="checkbox"/> | Location Map with all appropriate information (township, range, section, scale, north arrow, and streets labeled) |
| <input type="checkbox"/> | Site Plan with appropriate information:   |
| <input type="checkbox"/> | -North arrow and scale  |
| <input type="checkbox"/> | - Project Boundary and adjacent parcel information  |
| <input type="checkbox"/> | -Sheet index and match lines  |
| <input type="checkbox"/> | -Lot numbers and approved street names  |



- ☐ -Existing and new main sizes and pressure zones
- ☐ ☐ -Point(s) of connection to the existing system
- ☐ ☐ -Water easements w/recordation information
- ☐ Blue Stake logo
- ☐ Sheet Index consistent with interior sheets
- ☐ Legend (included all relevant standard symbols and linetypes)
- ☐ General notes per City of Eloy requirements
- ☐ Basis of Bearing (same as subdivision plat or development plan)
- ☐ Basis of Elevation (must be referenced to an approved City of Eloy benchmark. The note must include the City's benchmark ID number and verbatim description of the point as it appears in the *City of Eloy Vertical Control List*).
- ☐ Fire flow requirements per the approved Master Water Plan.
- ☐ Approval signature blocks (City of Eloy Public Works Department, Fire Department).
- ☐ Engineer's Logo and signed PE seal on every sheet.
- ☐ Project name and Owner/Developer name, address and telephone number

### **C. PLAN SHEETS**

- ☐ North Arrow, scale and sheet match lines.
- ☐ Existing water system mapped correctly including size, zone, and material.
- ☐ Blue Stake note.
- ☐ All new water system plotted bold (1.02mm) and labeled with size and type.
- ☐ Right-of-way widths dimensioned with streets labeled by name and as public or private.
- ☐ Existing and proposed pavement, sewer, utilities, drainage facilities and other potential conflicts in vicinity of new water mains.
- ☐ Electrical pedestals and transformers clearly shown and dimensioned 10' minimum from water services and hydrants.
- ☐ Sewer/Water crossings clearly shown with invert and clearance labeled.
- ☐ Show and label existing and proposed easements with recordation information.
- ☐ ☐ Appropriate survey data provided for all radial water main alignments. Verify compliance with allowable radial deflection per City's Design Guidelines.
- ☐ Development tied down to existing or proposed monuments.
- ☐ Meter size, type and location with station labeled. Must be located at property to be served with minimum 36" separation between service taps.



- ☐ Valves, fittings, ARVs, PRVs, and meters labeled, stationed, and called out only once.
- ☐ Appropriate valves on all new pipes ( two at a tee, three at a cross).
- ☐ Fire hydrants labeled and stationed and located per approved Master Water Plan.
- ☐ Stubs and drain valve assemblies shown and clearly labeled.
- ☐ In-line valves provided per ADEQ requirements.
- ☐ All required separations between potable, non-potable and sanitary sewer clearly shown.
- ☐ ☐ Pavement replacement shown where required.
- ☐ Project boundary and adjacent land uses clearly shown.
- ☐ Extend mains to property boundary for future connections consist with approved Master Plan.``

**D. WATER MAIN PROFILES (if applicable)**

- ☐ ☐ Required for all mains 12" and larger in pavement.
- ☐ Profiles may also be required at the City's discretion for smaller mains in areas where numerous or complex subsurface constraints are present or main is outside of road ROW.
- ☐ All profiles scaled at 1"=40' (Hor.) and 1"=4' (Vert.).
- ☐ All crossings with sewer, storm drain, existing water, non-potable water clearly shown and dimensioned.
- ☐ Vertical and rotated bends with inverts and stationed. **Note: Vertical bends need not be labeled in the plan view if shown in profile.**
- ☐ Pipe slopes, size, and material type clearly shown.
- ☐ Grade breaks stationed and labeled with invert.

**OWNER/DEVELOPER**

NAME: \_\_\_\_\_

ADDRESS: \_\_\_\_\_

\_\_\_\_\_

PHONE: \_\_\_\_\_

CONTACT: \_\_\_\_\_

**DESIGN FIRM/CONSULTANT**

NAME: \_\_\_\_\_

ADDRESS: \_\_\_\_\_

\_\_\_\_\_

PHONE: \_\_\_\_\_

CONTACT: \_\_\_\_\_

\_\_\_\_\_  
Designer's Signature

\_\_\_\_\_  
Date



*City of Eloy Public Works Department*

**CITY OF ELOY, PUBLIC WORKS DEPARTMENT**  
**SECTION 3**  
**WATER FACILITY MINIMUM SIZING AND RELIABILITY STANDARDS**

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**3.0 WATER FACILITY MINIMUM SIZING AND RELIABILITY STANDARDS**

**3.1 General**

**3.1.1 Purpose**

This section describes the minimum sizing criteria design and reliability standards for development of the City of Eloy potable water system.

**3.1.2 Applicability**

The requirements listed herein apply to all water projects. Additional requirements are contained in other section specific system components.

**3.2 Water Pressure**

**3.2.1 Water System Boundary**

**A. Public Water System**

The public water distribution system ends at a location that includes the water meter.

**B. Customer's Water System**

The customer's private plumbing system begins at the discharge side of the water meter (AAC R18-5-101.91)

**3.2.2 Minimum Dynamic Pressure**

A potable water distribution system shall be designed to maintain and shall maintain a pressure of at least twenty pounds per square inch at ground level at all points in the distribution system under all conditions of flow, as required by AAC R18-5-502.B, Minimum Design Criteria.

**3.2.3 Static Pressures**

Water is to be provided at the utility's water service connection, within a static pressure range of thirty-five pounds per square inch to eighty pounds per square inch.

**3.2.4 Customer's Pressure Responsibilities.**

**A. Applicable Pressure Regulations**

Uniform Plumbing Code, 1994 Edition, limits the water pressure within the customer's facility to a minimum of fifteen pounds per square inch and a maximum of eighty pounds per square inch.

**B. Pressure Regulation Devices**

- When the public water system pressure in Section 3.2.3 is met at the meter, it is the responsibility of the customer to increase the water pressure when the supply in the customer's plumbing is less than fifteen pounds per square inch or if a plumbing fixture requirement is higher than fifteen pounds per square inch.
- Reducing the pressure eighty pounds per square inch at the meter to meet any specific user requirements when is the responsibility of the customer.

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- When a pressure reducer or a booster pump is installed, a closed system may be created. The customer is responsible for reviewing local plumbing codes for pressure relief and thermal expansion device requirements that are intended to prevent damage to the customer's piping and fixtures.

**3.2.5 Dynamic Pressure and Flow, Computerized Modeling**

Hydraulic computerized models of the existing water system will be used to assist in sizing and locating public water system improvements.

**A. Water System Models**

The results of analysis using computer based model of the existing system and proposed expansions shall be used to determine whether proposed water system improvements meet the requirements for water pressure, headloss, velocity and storage.

**B. Surge Protection Models**

The City of Eloy will review proposed new pipelines, large services and facility plans for adequate surge protection. Analysis of surge modeling shall help determine the need for mitigation of water hammer in the design stage and will be submitted by the Design Engineer, as requested by the City Engineer. The designer shall design and submit the methods and equipment proposed for surge protection of the City of Eloy system.

**C. Responsibility for Computer Models**

In general, the City will perform the required hydraulic analysis analyze how a proposed water expansion will meet and peak demands and how it will impact the remainder of the system. However, the City may at its discretion direct the Design Engineer to provide model results. In these cases the City shall:

- Ø Provide to the Engineer current model data for use with H2ONet software, including existing pipe layout and demand data, or
- Ø Provide the residual system pressure at the intended point of connection to the existing water system based on demands calculated by the City Engineer.

**3.3 General Water System Design Criteria**

The criteria used for water system planning and improvements due to an individual project includes the following types of water use:

- General Service Requirements
- Fire Suppression Service Requirements

All proposed projects project must include all the water system improvements needed to maintain water system pressure while meeting the project's future water demands. The water improvements may include pipelines, pumping stations, storage facilities, and wells. They may be "on-site" and/or "off-site" depending upon the project's specific location and needs as well as the projects overall compliance with the City's Master Water Plan.

**CITY OF ELOY, PUBLIC WORKS DEPARTMENT  
SECTION 3  
WATER FACILITY MINIMUM SIZING AND RELIABILITY STANDARDS**

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**3.3.1 General Service Requirements**

**A. Average Daily Demand**

At the individual project level, average daily demand includes residential and nonresidential types of water uses averaged over a one-year period:

**1. Residential Use**

- a. The gallons per capita per day value is 125 for residential units to include single, multi-family, townhouse, and condominiums.
- b. The persons per housing unit value is 3.0 for new residential units. Variations to this factor may be proposed by the Design Engineer for age restricted communities for consideration and approval by the City Engineer.

**2. Nonresidential Use**

- a. Commercial and Industrial Use – 2,000 gallons per acre per day (1.39 gallon per minute per acre) shall be used if no more specific data is available.
- b. Turf – 3.0 acre foot per acre of turf, total annual demand minimum calculated by engineer.
- c. The project designer shall provide detailed calculations for the project site's intended use, including peak demands.

**B. Water Demand Peaking Factors**

The factors to be used for determining peak water demand, for individual project-level design include the following:

1. The average day of the maximum month demand factor is 1.5 times the average daily demand.
2. The maximum day demand factor is 2.0 times average daily demand.
3. The peak hour demand factor is 3.50 times average daily demand.
4. Maximum day factor for turf is 2.64 times average daily demand.

**3.3.2 Fire Suppression Service Requirements**

**A. Project Requirements**

The water project design shall include the fire flow requirements of the fire suppression authority. Since the fire flows listed herein are added to the maximum day demand requirements, the total flow rates required will be greater than the fire flow requirements alone.

**B. Fire Suppression Authority Requirements**

- The Design Engineer shall consult with the appropriate fire suppression authority for the required fire flow rates, in gallons per minute, and for the associated fire flow duration (in hours).
- This information shall be provided on the water plans with a signature for the fire suppression authority indicating approval of fire hydrant placement and the required flow rate and duration.

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**3.4 Water Pipeline Sizing Criteria**

**3.4.1 Demand Conditions**

The demand conditions in the water distribution system for each individual pipeline and appurtenance, such as pressure-reducing valves, include maximum day demand and fire suppression requirements. This includes the total service connections to be served by the pipeline, including future connections if the project is constructed in phases or where extensions of the pipeline are possible. Also see ADEQ Engineering Bulletin No. 10, Chapter 7 – Distribution Systems.

**3.4.2 Minimum Pipeline Sizing Requirements**

**A. Distribution System Minimum Size**

The minimum pipe size for a looped distribution main shall under no circumstance be less than eight inches. Final determination of the pipe size will be based on hydraulic analysis and with consideration for other known or anticipated future demands. In certain situations where a dead-end is unavoidable, a six inch main may be used depending on the specific circumstance and pending approval by the City Engineer.

**B. Transmission Mains Sizing Requirements**

All transmission mains shall be sized based on ultimate demands as identified in the City of Eloy Water System Master Plan. Transmission mains on section lines or extending along major spine roads shall be a minimum of 16" inches in diameter unless hydraulic modeling and master planning clearly justify a smaller pipe.

**3.4.3 Pipeline Velocity and Headloss Limitations**

**A. Distribution System Pipelines**

**1. Maximum Day Demand Conditions**

For pipelines twelve inches or less, the velocity shall not exceed five feet per second

**2. Maximum Day Demand Plus Fire Flow**

Although there is no specific velocity criteria, the 20 psi residual pressure must be met throughout the system during this demand condition.

**B. Transmission Mains**

In transmission mains sixteen-inches or larger, the velocity shall not exceed five feet per second under any conditions.

**3.4.4 Water Service Line Sizing**

This standard applies to the pipeline between the distribution system and the water meter.

**A. Single Water Service Connections**

The minimum pipeline size for a single 5/8-inch service connection is one inch, inside diameter.

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B. Split Water Service Connections

The minimum pipeline size for a split 5/8-inch service connection is 1.5 inch, inside diameter.

3.4.5 Reliability Standards of Water Pipelines

At a minimum, the average daily demand shall be met whenever any pipeline is out of service, with the exception of dead-end mains as approved by the City Engineer.

A. Parallel Pipelines

Parallel lines may be required at the discretion of the City Engineer if looped pipelines are not feasible or where two different pressure zones converge to serve the project.

B. Looped Pipelines

Wherever practicable, any individual new distribution system pipeline shall have two separate points of connection to the overall system in order to provide two water from two direction in the event of pipe service or repair.

C. Dead-End Mains

The City shall evaluate the potential for a looped connection at all proposed dead ends. When the use of a dead-end water main is unavoidable, a drain valve or flushing hydrant shall be provided at the terminal end of the water main. This will permit the flushing of the water main to improve water quality by discharging stagnant water and particulate matter.

**3.5 Water Storage Facility Sizing**

3.5.1 Types of Storage Facilities

Storage capacity is met by use of elevated or ground storage facilities. For purposes of these design standards, the following terms are used:

- "high-water storage" will be used instead of "elevated storage," and
- "forebay" will be used instead of "ground."

A. High-Water Storage

Any storage facility is considered to be high-water storage if it is at an elevation above the upper zone boundary elevation of that portion of the distribution system it serves.

- Thus, ground or subsurface tanks built on high ground are called high-water storage (defined by ADEQ and American Water Works Association as elevated storage). High-water storage can also be referred to as gravity storage tanks or reservoirs
- There is limited opportunity for high-water storage in the City of Eloy.
- This type of configuration is classified as an open system because it is open to atmospheric pressure.

B. Forebay Storage

Forebay storage is typically used as a source of water supply that is re-pumped to another service area at a higher elevation, or into the distribution system for which it was designed to serve.

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3.5.2 Water Storage Sizing Criteria

A. Objectives

For the service area that the regional water storage facility is intended to serve, the total net (usable) capacity of the storage facility shall provide components for:

- flow and pressure equalization,
- fire suppression, and
- an emergency water supply.

Net capacity is less than gross capacity due to the unusable volume of the storage facility. This unusable capacity is dependent upon the shape of the storage facility and the elevation of the outlet pipe. These objectives are also further explained in ADEQ Engineering Bulletin No. 10, Chapter 6, Water Storage. The storage facilities are called reservoirs or tanks, depending on their size and materials.

B. Equalization Storage Component

The storage component for equalization is required to meet water system demands in excess of water production capabilities, and is equal to 1.0 times the average daily water demand. Water production capabilities (water supply facilities) are sized to meet a minimum 1.5 times the average day demand.

C. Fire Suppression Storage Component

The following criteria shall be used to determine the storage component for fire suppression of the total volume required initially and at full build-out of the area intended to be served by the regional storage facility.

1. Service Sub-Area

- Each regional storage facility shall be able to provide the fire suppression requirement within its service area.
- The effective service boundary is a function of the water maximum day demands, fire flow requirements, and distribution piping capacity.

2. Minimum Fire Suppression Component

The storage component for the minimum fire suppression requirement shall be based on the largest structure that requires the highest flow rate and associated duration as determined by the appropriate fire suppression authority.

D. Minimum Emergency Storage Component

To meet demands in the event of an emergency situation, such as a power outage, a line break or a pumping station failure:

1. The emergency storage component shall be at least 0.50 times the overall average daily demand of the area served by the reservoir. For isolated systems with minimal source redundancy, the minimum emergency storage component shall be determined by the City and shall be at least the maximum day demand for the overall area served by the reservoir

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2. Due consideration shall be given to the water service area that the regional storage facility serves as well is redundancy provided by interconnects to adjacent regional facilities. This may cause the minimum emergency net storage volume requirement to increase or decrease. A decrease will be allowed only if offset by an excess storage component in another storage facility located in the same pressure zone.

**3.5.3 Additional Water Storage Facility Requirements**

**A. Storage Facility Phasing**

Storage facilities may be phased if justified by an economic, engineering and operational analysis. Each storage facility shall meet all fire flow and emergency storage requirements projected for the duration of each phase. The projected water demand for each phase of the project shall be submitted to the City Engineer for review.

**B. Storage Facility Operating Levels**

1. For high-water storage, the upper operating level in the storage facility will be at the high-water elevation of the zone to be served by the storage facility.
2. The depth between the upper operating level and lower operating level of a storage facility shall be determined by the City Engineer during the design process based on the height of the tank and the projected demands.
3. Storage facilities shall be located above the 100-year flood prone area, with in-ground storage facilities also located above the groundwater table.

**C. Storage Facility Pipeline Size**

Pipelines serving the storage facility must be of sufficient size to provide the design flow out of the facility, as well as the refill flow into the facility, and shall be sized to meet the ultimate demands of the projected service area for the reservoir.

**3.6 Booster Station Requirements**

A water system serving that provides pressure solely by pumping is classified as a closed water system because it is not open to atmospheric pressure, as is the case when there is a high water storage facility. The type of system uses a hydro-pneumatic pressure tank to control pump operation, to minimize pump cycling, and to meet instantaneous water demand.

**3.6.1 Hydro-Pneumatic Pressure Tank**

The purpose of the hydro-pneumatic pressure tank system is to:

- Develop and maintain pressure in the water system by means of compressed air as an alternative to high water storage

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- Minimize pump cycling. (Cycling is the turning on-and-off of a pump, which increases the wear and tear on a pump much more than the constant running of a pump.), and
- Control or boost a limited supply pressure to a higher or more uniformed value so that a continuous and satisfactory water supply is provided.

These closed water systems typically serve water service areas where it is not possible to construct a high water storage facility. The minimum volume for a hydro-pneumatic tank (both discharge and suction) to be utilized at a regional facility is 5000 gallons. Tank size refers to the total internal volume for water and air. The water volume typically represents ten to fifty percent of the total tank volume.

**3.6.2 Pumps and Pipe Sizing**

**A. Total Capacity of Pumping Station**

1. Because there will generally be no gravity storage is no storage within most of the overall service area, the total capacity of a regional pumping shall include Maximum Day Demand plus fire flow, or Peak Hour Demand (whichever is greater) at ultimate build-out of the service area.
2. All piping within the pumping station shall be sized for the total water demand at planned build-out of the service area.

**B. Initial Pump Sizes**

**1. Sizing of Initial Pumps**

The initial set of pumps installed in the pumping station shall be sized for the total water demand during the pump's estimated life, usually 10 years. Special provisions for some lesser capacity may be made with approval by the City Engineer when low demands are anticipated for an extended period of time.

**2. Net Pump Capacity**

A sufficient number of pumps shall be selected to work together at the same discharge pressure in order to provide required total station capacity. In all cases, a larger "gross capacity" sum of the pumps is required to reach the net operating output required.

**C. Pump Cavitation**

Pump sizing shall not exceed capacity of the suction line or the NPSH requirements of the pump.

**D. Pumping Station Piping**

**1. Velocity for Total Capacity**

Pumping station pipelines shall be sized at 5 feet per second maximum velocity for discharge piping, 3 feet per second maximum for suction piping, based upon total station capacity.

**2. Reserved Space for Pump Additions**

Typically, space along the manifold and ground at the pumping station site is reserved, with blind flanged lateral(s) provided, for future pump additions anticipated to meet total water demand at planned build-out of the area.

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**3.6.4** Reliability Standards of Pumping Stations

The distribution system will include pumping station (closed system) redundancy whenever possible for increased reliability of service to the City of Eloy customers. The greater of Maximum Daily Demand plus fire flow or Peak Hour Demand shall be met during any interruption of the primary power supply, planned or unplanned, for the customers served by a pumping station.

A back-up power source shall be provided at all regional booster facilities which accommodates all electrical loads at full production capacity. Specifics regarding back-up power at booster stations are provided in Section 6.

**3.7** **Production Well Requirements**

**3.7.1** General

A. Interconnected Water System

The total water production capacity for a regional facility that is interconnected to an adjacent facility shall be at least 1.5 times the Average Daily Demand.

B. Isolated Water Systems

There shall be a minimum of two wells for the reliability of isolated systems that are not interconnected to an adjacent regional water facility. The production capacity of the smallest producing must be equal at least the Maximum Day Demand for the service sub-area.

C. Quantity of Source

Although a development may receive certification of an assured water supply, the development of the water production source at the quantities required is the responsibility of the developer.

**3.7.2** Minimum Physical Requirements

A. Well Site Dimensions

The minimum well site where no storage or booster station is provided shall be 100 feet by 100 feet. The Public Works Department shall review all proposed site plans for sufficient room for:

- a second well
- pressure tanks
- parking within and outside of the site
- drill rig, pipe and well maintenance vehicles
- emergency power source
- turn around access
- minimum distance from septic systems or other potential contamination sources
- compliance with local zoning code

B. Well Size and Acceptance Criteria

1. The typical well size minimum standard consists of a well casing diameter of twenty inches. Detailed well construction and acceptance criteria can be found in Section 7

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2. Aquifer testing shall determine aquifer parameters and maximum sustainable yield for the well.
3. Developed well shall contain no more than 0.1 mg of silt and suspended solids per liter of water at maximum discharge capacity.

**C. Source Protection**

1. The minimum depth for watertight protection from surface contamination shall be ten feet. Additional discussion can be found in ADEQ Engineering Bulletin No. 10, Chapter 2 – Source Development and Construction, Section D. Groundwater Source Development, subsection 5. Source Protection.
2. Well casing vents shall consist of tamper-resistant materials and be secured with a commercial grade pick-resistant lock, to prevent unauthorized access.
3. Comprehensive water quality testing meeting or exceeding minimum State and Federal listed constituents standards shall be performed, taking into account local mineralogy and history.

**D. Supply Pipeline**

The minimum size of a well supply pipeline to the distribution system shall be sized to maintain maximum velocity of five feet per second based on the well yield.

**E. Well Location**

Proposed well sites shall be reviewed by the Public Works Department to ensure site does not adversely impact existing wells, aquifers, or neighborhoods. Sites shall meet or exceed well sitting restrictions as detailed in AAC R12-15-818 (Well Location); and ARS Title 45 (Waters). Article 4 (Groundwater Rights and Uses In General), Article 10 (Wells).

**3.7.3 Reliability Standards of Water Wells**

A back-up power source shall be provided at select well facilities, which accommodates all electrical loads at full production capacity. At a minimum, back-up power must be provided at enough wells within any given regional facility service area to provide 1.5 times the Average Day Demand under all conditions. Specifics regarding back-up power at wells stations are provided in Section 7.

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**4.0 WATER PIPELINE DESIGN STANDARDS**

**4.1 General**

**4.1.1 Purpose**

This section describes the design standards and requirements for public water pipeline projects.

**4.1.2 Applicability**

Requirements listed herein apply to developer-financed expansions and modifications of the City of Eloy Water System.

**4.2 Water Pipeline Design Requirements**

The requirements described below are based, in part, on ADEQ Engineering Bulletin No. 10, Chapter 7, Distribution Systems.

**4.2.1 Pipeline Pressure Rating**

All water pipelines in a water service area with a single or double water pressure zone shall be designed for a minimum internal pressure of 150 pounds per square inch (psi).

**4.2.2 Detailed Pipeline Design**

**A. Material Selection**

Approved materials for new water mains in the City of Eloy include ductile iron pipe per MAG Standard Specifications (Section 750), and PVC pipe per City of Eloy Supplemental Standard Detail SWD 1000. All other materials shall require approval by the City Engineer.

**B. Pipeline Location**

Water pipelines shall be placed in public road right-of-way per SWD-1100. Pipe may also be positioned in the center of an easement dedicated solely to the City of Eloy for utility installations or in a dedicated utility corridor where possible. The minimum width of an easement dedicated solely for a water main shall be 16 feet. The width and layout of a proposed utility corridor containing multiple utilities will require approval of the City Engineer.

**C. Pipeline Length**

All water pipeline extensions shall be installed in the adjacent street or easement, the entire length of the property to be served.

**D. Looped Connections**

The developer shall design and construct all offsite water pipelines as necessary to complete a looped connection to existing mains and provide the required water flows to the development.

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**E. Pipeline Depth**

Sufficient cover, distance from top of pipe to final grade, is necessary to give protection against traffic live and dead loads and provide anchorage for normal sections of straight pipe.

**1. Minimum Depth**

- a. The depth of cover to the top of the pipe shall not be less than *forty-four* inches unless adequate structural protection is provided and justified by the design engineer, and approved by Public Works Department. If the design engineer directs that more cover is needed, it shall be noted on the plans.
- b. Within a non-final grade right of way such as in undeveloped areas and areas outside of public road right-of-way, mains shall be installed with a minimum of sixty inches of cover from the existing grade which shall also be noted and shown on the profile plans.
- c. Final grade shall be defined as an existing or proposed roadway that includes permanent curbs.
- d. All transmission mains (sixteen-inch or larger) shall have a minimum of *sixty* inches of cover from final grade.

**2. Calculated Depth**

Under certain conditions and pipe materials, the depth of cover must be calculated to provide distribution of external stress from superimposed loads. These include static and dynamic forces.

- Static forces may include overlying material, such as earth fill and the weight of traffic over a deeply buried pipeline.
- Dynamic forces may include traffic impact loads due to moving vehicles on highways and railways.

**F. Grade Breaks and Horizontal Deflections**

**1. PVC Pipe**

For 12" and larger pipe, grade breaks and horizontal deflection in PVC pipe design is not permissible at joints. PVC pipe design deflections shall be accomplished in the pipe longitudinal bending in accordance with the manufacturer's recommendations. Otherwise, fittings shall be used for grade breaks or horizontal deflections.

**2. Ductile Iron Pipe**

Grade breaks and horizontal deflection in ductile iron pipe design may be accomplished at joints. Pipe deflections shall be in no case more than one-half the maximum manufacturer's recommendations. Otherwise, fittings shall be used for breaks or deflections.

**G. Transmission Main Tees**

Tees in a transmission main normally shall be no closer together than 1,320 feet, unless approved by City Engineer. There shall be the smallest number of tees required to provide an adequate and redundant supply to that portion of the distribution system.

The smallest tee in a transmission main shall be eight-inches in diameter. The smallest tee for air relief valve and drain valve appurtenances is four-inches in diameter, with City of Eloy approval.

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H. Thermal Contraction/Expansion of Pipelines

In certain fixed and rigid pipeline installations, the design engineer shall consider thermal movement of pipeline materials, and provide provisions in the pipeline design to compensate for thermal contraction and expansion. The most likely case of this situation within the City of Eloy is at bridge crossings over existing irrigation canals.

4.2.3 Pipe Restraint

A. New Pipeline Design/Construction

1. For new pipe, mechanical joint restraints shall be used in place of thrust and anchor blocks where required.
2. In the event thrust and anchor blocks are unavoidable due to engineering constraints, placement of the blocks must not cover or encase the fitting or pipe joints. Joints and end caps must remain functional

B. Existing Pipeline Modification/Construction

1. Generally, the use of thrust blocks is not recommended and will be subject to approval.
2. In the event the use of thrust and anchor blocks is unavoidable, placement of the blocks must not cover or encase the fitting or pipe joints. Joints and end caps must remain functional.
3. The design engineer, and not the contractor nor the inspector, shall make the determination of whether or not a given section of existing pipeline that is to be modified needs mechanical joint restraints or other means of anchorage. If the design engineer directs that it is needed, it shall be noted on the plans, or in a contract supplemental agreement.

C. Thrust Blocks

In the event thrust and anchor blocks are unavoidable the following shall be utilized for design:

1. MAG SD-380, Thrust Blocks for Water Lines. The information furnished in MAG SD-380 is based on very limited design parameters which must be verified before relying on the detail.
2. Variances from MAG SD-380.  
When project specific conditions vary from the design parameters listed in MAG SD-380, such as when the pressure may exceed 200 pounds per square inch (including surges) or when the pipe is larger than sixteen inch, additional information and calculations are needed. In such a case, the practices found in the Manual of Water Supply Practices – M9, Concrete Pressure Pipe, by the American Water Works Association, shall be followed
3. Allowable Soil Bearing Capacity.  
The allowable bearing capacity is taken as the ultimate bearing capacity divided by a safety factor against shear failure or excessive settlement.
4. Factor of Safety.  
The factor of safety is 2.0 for cohesion-less soils (sands), 3.0 for cohesive soils (clays).

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5. Undisturbed Soil.

When approved by the City of Eloy, thrust block designs of sufficient size to reduce the pressure on the soil to the allowable bearing capacity of the undisturbed soil shall be provided to resist downward vertical thrust and horizontal thrusts.

6. Disturbed Soil.

In the event of disturbed soils, an aggregate base course backfill material and compaction complying with Section 702 of the MAG Uniform Standard Specifications for Public Works Construction, most current Edition, shall be provided to resist vertical and horizontal thrusts, as determined by a qualified and registered Professional Engineer.

D. Mechanically Joint Restraints

1. Joint Restraint for for PVC and Ductile Iron Pipe

Designers of PVC and ductile iron pipe, 12" or less in diameter, shall use City of Eloy Supplemental Standard Detail SWD-800 to determine the required restrained joints lengths. The information furnished in SWD-800 is based on specific parameters listed within the detail.

2. Variances from SWD-800

When project specific conditions vary from the design parameters listed in SWD-800, such as when another pipe material other than PVC or DIP is proposed, the pressure may exceed 200 pounds per square inch (including surges), or when the pipe is larger than 12" additional calculations shall be provided.

In such a case, the restrained joint length design standard practices found in the specific pipe material manuals shall be followed, such as:

- Manual of Water Supply Practices – M9, Concrete Pressure Pipe, by the American Water Works Association for concrete pipe
- DIPRA and AWWA M41 for ductile iron pipe, or another method approved by industry standards, shall be followed.
- Restraint Length Calculator Software for PVC and DI pipe distributed by EBAA Iron ([www.ebaa.com](http://www.ebaa.com)).

4.2.4 Utility Separation Requirements

A. Sewer Separation Requirements

Installation of water pipes near sanitary sewer mains shall comply with the following to prevent potential cross connection issues:

1. State of Arizona Criteria.

- a. AAC R18-5-502.C, Minimum Design Criteria, Water and Sewer Mains, includes requirements for separation of facilities, materials, types of joints and encasement. For additional detail, refer to SWD-300 in the City of Eloy Supplemental Standard Specifications and Details
- b. All the requirements of SWD-300, Sewer/Water Crossing Details, City of Eloy Supplemental Standard Specifications and Details, must be met.

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- c. All public water and sewer line invert elevations shall be shown on the design drawings and the record drawings at each crossing to verify the separation requirements.

- 2. Reclaimed Water Pipes

Reclaimed water pipes located adjacent to potable water pipes shall comply with the separation criteria established for pressure sanitary sewer lines. Where reclaimed water pipes are installed in the vicinity of sanitary sewer lines, the reclaimed water pipes shall be considered potable with respect to clearances.

- B. Other Utility Separation Requirements

Other utilities are defined as primary and secondary electric power, natural gas, fiber optic, communications, petro-chemical, telephone and cable television lines, conduits or structures.

Water main installation shall conform to the following separation requirements concerning other utilities:

- 1. Horizontal and Vertical Separation

Water mains shall not be designed for placement within a five foot horizontal distance of parallel utility lines. The minimum vertical separation, at any location, shall be twelve inches.

- 2. Property Corners

Customer water services and fire hydrants shall not be installed at the same property corner as electrical or communications pedestals or transformers. This will minimize the risk of damage during installation and facilitate water system maintenance.

If this requirement absolutely cannot be met, there shall be a minimum horizontal distance of ten feet between the other utility's structures and the water mains and waterworks structures.

- C. Joint-Use Trench Separation Requirements

When other utilities are laid parallel to water facilities, they shall not be installed with less than five feet horizontal clearance from the water main unless the joint trench detail has been approved by the City Engineer. In these cases, the joint-use trench detail must be shown on the plans.

- D. Storm Drain Separation Requirements

The requirements stated in this section are in addition to the requirements presented in SWD-400 of the City of Eloy Supplemental Standard Specifications and Details.

- 1. Water Pipe Below Structure

When the water main is to be installed below a storm drain structure, the minimum vertical separation shall at all times be in accordance with City of Eloy Supplemental Standard Detail SWD-400.

- 2. Water Pipe Above Structure

When installing water mains over a storm drain structure and minimum cover cannot be achieved, the contractor, with the approval of the City Engineer, may install the water main with less than the minimum cover under the following

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conditions:

- a. The water pipe material shall be ductile iron.
- b. Separation between the water main and the top of the storm drain structure shall be no less than twelve inches.
- c. Under no circumstances shall the pipeline have less than twenty-four inches of cover to final grade.

**4.2.5 Crossing Requirements**

**A. Surface Water Crossing Requirements**

**1. Above Surface Water Crossings**

Above surface water crossings occur on bridges or on a suspended cable, and are not acceptable without approval of the Public Works Department and Owner/Agency authorized representative.

**2. Below Surface Water Crossings**

- a. Prepare a hydrologic/hydraulic report for all crossings under surface water features where scour may potentially occur.
- b. The design of the pipeline and any other support structures shall include restrained joints within the flood limits. ADEQ Engineering Bulletin No. 10 contains the following additional requirements:
  - The water pipeline shall be located a minimum of two feet below the scour depth.
  - There shall be two valves, one at each side of the crossing, which are accessible and not subject to flooding.

**3. Pipelines Parallel to Surface Water Crossings**

Extra protection shall be considered for pipelines parallel to a river, stream, or wash that has a history of bank erosion or appears likely to be subjected to future erosion.

**B. Utility and Transportation Crossing Requirements**

**1. Utilities Crossing Requirements**

The companies of the following utilities shall be contacted for the latest crossing requirements:

- natural gas pipelines
- gasoline pipelines (petroleum products)
- telephone lines,
- military installations,
- irrigation lines or canals.
- communications cables or conduits
- electric lines, or conduits,
- fiber optic cables or conduits

**2. Transportation Crossings Requirements**

**a. Crossing Minimum Requirements**

The design of a water main crossing under ADOT right-of-way or other major public roadway where a trench excavation is not considered practical shall be as follows:

- A sleeve or casing shall be used to jack and bore beneath

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the crossing to avoid disturbance of the traffic system.

- The wall thickness of the sleeve or casing shall be sized to withstand H-20 traffic loading and or transportation agency specifications.
- There shall be two valves, one at each side of the crossing. The designer shall locate the valves out of the flood plain and minimize the number of customers that would be out of service.

b. Jacking and Boring

Calculations are required for the design of steel jack and bore casing diameter and thickness sizing, and design shall be pursuant to SWD –900 of the City of Eloy Supplemental Standard Details. The carrier pipe shall be restrained beyond the ends of the casing for a minimum of 18-inches or equal to one-half times the carrier pipe diameter, whichever is greater.

### **4.3 Water Pipeline Appurtenance Requirements**

#### **4.3.1 Valve Requirements**

Valves shall comply with all applicable AWWA and ANSI specifications for potable water systems. Furthermore, design consideration shall be given to the following applications:

A. Shutoff Valves in Distribution Mains

Types of shutoff valves include gate, ball, and corporation stops.

1. Shutoff Valves in Water Distribution Mains

Generally, a water distribution main (12" diameter and smaller) includes any pipe if direct water service to an individual customer is provided from that pipe. Shutoff capability on distribution mains shall be achieved through the use of gate type valves.

- The shutoff valves are used to divert flow around an area or distribution section needing maintenance or repair while minimizing customer service interruptions.
- Special consideration shall be given to minimize the number of fire hydrants taken out of service.
- The valves in a new distribution system shall be located so as require closure of no more than four valves to isolate a specific water main. A project for a new pipeline may have to add new valves to the existing water system to meet this requirement.

B. Shutoff Valve Location

Within the distribution piping shutoff valves are required in:

- commercial areas – at all pipe intersection and no less than every 500 feet
- all other areas – every 660 feet or at pipe intersections.

C. Intersections in Distribution Mains

The number of shutoff valves at distribution main intersections is one less than the number of radiating pipes. One valve will be omitted from the pipeline that principally supplies flow to the intersection.

D. Fire Hydrant Branch

One shutoff valve is required on each fire hydrant branch. Refer to MAG SD-360.

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**E. Gate Valve (Bonnet) Cover Minimum**

The gate valve bonnet shall have a three-foot minimum cover distance from the top of bonnet to the roadway subgrade for gate valves 6" through 12", and 18" cover for 16" pipe. Bonnet for the actuator of a butterfly valve shall be 36" minimum.

**F. Isolation Valves in Transmission Mains**

Isolation valves used in transmission mains (generally 16" diameter) are to be butterfly valve type.

**1. Location of Isolation Valves**

At pipeline intersections, isolation valves shall be located upstream of the determined predominant flow pattern so that, when closed, there will be the least disruption of service to the water customer and shall permit the necessary shut down of transmission mains for maintenance or repair.

**2. Separation of Isolation Valves**

Although each project's valve placement will be evaluated separately and will be dependent upon the location of the tees/welded outlets for distribution system lateral tie-ins to parallel or crossing mains, in-line isolation valves are generally located:

- Every 1,320 feet for up to 16" pipe,
- Every 2,640 feet for 16" pipe and larger up to 36" pipe.

**G. Flushing Devices**

Flushing devices take on various names depending on the intended use or purpose. These include blow-off valve assemblies, drain valve assemblies, and fire hydrants. Some form of flushing device shall be required at all dead-end mains, and at strategic locations on mains where it is believed stagnation of water may be an issue due to sizing of the main for ultimate demands.

The following criteria shall be used when determining selection of a flushing device:

- For 8" mains and smaller, a drain valve assembly consistent with SWD-600 shall be used at all dead-ends.
- For 12" mains and larger, hydrants shall be located as to facilitate proper flushing of the main.

**H. Air and Vacuum Release Valves**

All air release valves shall be a combination air/vacuum release type.

Air release valves are required at critical high points in all pipelines, in which there are no connections, such as a fire hydrant or a water service connection that would otherwise permit accumulated air to be released. When a shut-off valve is also at the high point in a pipeline, air release valves shall be provided on each side of the valve.

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Installation of air release valves shall be per SWD-500. Special attention shall be given to grading around the valve box to ensure all drainage is directed away from the box. Valve boxes for air release valves shall be tamper proof to avoid deliberate contamination of the water system.

**J. Air Valve Capacity**

In general, a 1" air release valve shall be sufficient for mains 12" and smaller, and a 2" valve shall be used for mains up to 24 inches. For larger mains, air release valves shall be sized by the Design Engineer

**4.3.2 Fire Hydrant and Stub-out Location**

None of the requirements stated in this section shall take precedence over the requirements in MAG SD-360, Fire Hydrant Installation.

**A. New Fire Hydrants**

1. The number of fire hydrants and their location shall be as approved by the local fire suppression authority without violating any other requirement contained herein.
2. Horizontal ninety-degree bends in fire hydrant laterals are undesirable and will be avoided when possible. If unavoidable, a minimum of ten feet of ductile iron pipe will be installed between the bend and the hydrant. Where practicable, the ninety-degree bend shall consist of two forty-five-degree bends.

**B. Fire Hydrant Replacement**

Unless otherwise directed by City of Eloy, fire hydrants will be replaced with a new hydrant during replacement of the adjacent main if:

1. the hydrant is more than ten years old, and
2. the hydrant is in poor visual or recorded substandard condition,

**C. Fire Hydrant Not Allowed**

**1. Transmission Mains**

There shall be no fire hydrant or service connections located directly on transmission mains over twelve-inches unless approved by the City Engineer.

**2. Extra Protection Near Sewer Mains**

There shall be no fire hydrant connections located where extra protection is needed near sewer mains as required by AAC R18-5-502.C, Minimum Design Criteria, Water and Sewer Mains. This will reduce any potential risk involving the fire hydrant barrel drain.

**3. Limitation of the Available Water Supply**

There shall be no fire hydrants installed where there is a limitation of the available water supply to provide the flow implied by the presence of a fire hydrant.

**4. Impediment**

The hydrant should be located so that it will not impede vehicular or pedestrian traffic, block driveways, take parking space, etc.

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**4.4 Water Pipeline Miscellaneous Requirements**

**4.4.1 Customer Water Service Connections**

A water service connection includes the service clamp or saddle, corporation stop, copper pipe, angle meter stop, tracer wire, locator tape, meter box and lid. Please refer to SWD-700 in the City of Eloy Supplemental Standard Specifications and Details.

**A. Customer Water Service Connections**

Each customer water service connection shall be individually metered. The customer shall install and maintain their own shutoff valves in their water service line (a.k.a. private plumbing) between the water meter and the customer structure, and shall be financially responsible for their water service line. A contractor or City of Eloy shall install the service connection.

**B. Customer Water Service Connections, Location**

1. For automated meter reading and easy access by vehicles, each water service connection shall be installed within the public right-of-way or an easement (approved by the Public Works Department for the project) and adjacent to the property to be served.
2. The water meter will be installed by the City of Eloy after the project has been accepted.

**C. Water Service Locations Not Allowed**

1. On water pipeline sizes over twelve-inches, there shall be no water service connections with the exception of special cases as approved by the City Engineer.
2. Where extra protection is needed near sewer mains as required by R18-4-502.C, Minimum Design Criteria, Water and Sewer Mains, no customer water service connections shall be installed.

**D. Irrigation and Fire Services**

For commercial developments, water used for irrigation will be separately metered. Fire services are un-metered. Installation of fire service will be in accordance with City of Eloy Water and Sewer Ordinances. Once the potable water enters these systems, it is then defined as nonpotable.

**4.4.2 Water Loading Stations**

Water dispensing facilities, such as those used to load water trucks, will be reviewed by the City of Eloy Public Works Department on a case by case basis. To prevent contamination of the potable water supply, the requirements described in ADEQ Engineering Bulletin No. 10, Chapter 7, Distribution Systems, Section K., Water Loading Stations, must be met.

**4.4.3 Landscape Plantings**

The requirements in this subsection have been established to protect City of Eloy water infrastructure after the planting of new landscaping adjacent to a water construction project. These facilities include water mains, sleeves, valves, water services lines, and

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water meters.

A. Large Root-Ball Sizes

For trees of fifteen-gallon root-ball size and larger, a horizontal distance of ten feet is to be provided from the outside of the waterline to the outside diameter of the root-ball.

B. Medium and Smaller Root-Ball Sizes

For plantings with smaller than fifteen-gallon root-ball sizes, a horizontal distance of five feet is to be provided from the outside of the waterline to the center of the plant root-ball.

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**5.0 WATER PLAN DRAFTING STANDARDS**

**5.1 General**

**5.1.1 Purpose**

This section describes water construction plan standards and requirements for public water projects. Water construction plans are stand-alone, and are not to be integrated into development plans, improvement plans or roadway plans.

**5.1.2 Applicability**

These requirements apply to all public water plans.

**5.2 General Drafting Requirements**

**5.2.1 Sheet Size and Scale**

The drawings shall be on standard 24" x 36" (+/- 1/32 inch) translucent bond. Final drawings shall be provided on Mylar sheets. The standard scale for drawings shall be 1"=40' (horizontal), and 1"=4' (vertical).

**5.2.2 Plan Symbols**

See MAG SD-110 and Exhibit 5-1 for acceptable drafting plan symbols.

**5.2.3 Lettering and Line Weights**

The purpose of this requirement is to assure that all lettering is legible when reviewed and will maintain that legibility when reproduced and scanned.

1. All lettering, line weights, and annotation shall be chosen and drafted to produce clear, not congested, and readable plans including when converted to half-size. The City reserves the right to reject plans which do not meet the industry standard of care for construction drawings.
2. Lettering and dimensions size shall be equal to or greater than 0.125". Letter line weight thickness shall be a minimum of 0.0100".
4. Proposed water line thickness shall be a minimum 0.035".

**5.2.4 Call-Out Notes and Text Boxes**

All plan view call-out notes shall be presented within a shadowed text box with the underlying plan features masked. Tapered arrows shall be utilized from the text box to the appropriate feature. Arrows shall not cross and the text boxes shall not cover relevant features within the plan. In the event that the plan becomes cluttered due to an excessive number of text boxes, then a minimum number keynotes may be used with the associated notes presented elsewhere on the sheet.

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**5.3 Content Requirements, Water Plan Sheets**

**5.3.1 Content Requirements, All Plan Sheets**

All sheets shall contain or meet the requirements as presented below.

**A. Project Title Block**

The title block shall be horizontally divided into three equal subsections and shall include:

**1. First Subsection:**

Project name, centered, in bold typeface sized according to project name

**2. Second Subsection:**

Second subsection of the title block, "sheet title block," shall identify the contents of the specific sheet (i.e. plan and profile, details etc.)

**3. Third Subsection:**

a. Names, Designed by dates, Drawn by, and Checked by

b. Scale: Vertical, Horizontal

c. Sheet number and total number of sheets

d. Plan Number

- A plan number must be obtained for each project from the Public Works Engineer.
- All project documents shall include a reference to the project using the City of Eloy project plan number.
- The City of Eloy project plan number will be applied in the margin as directed by the Public Works Engineer.

**B. City of Eloy Logo and Engineer's Seal**

1. The Engineer's seal and signature shall appear on each sheet of drawings or maps.

2. The Engineer shall sign, date, and seal a professional document before the document is submitted to City of Eloy or any other regulatory agency, unless the document is marked "preliminary," "draft," or "not for construction." Refer to AAC Rule R4-30-304. Use of Seals, to assure compliance with all requirements of this rule.

**C. Consultant's Logo**

Consultant's logo with clear identification of the firm responsible for design, if applicable.

**D. North Arrow**

The north arrow shall be located in the upper right corner of the plan view whenever possible.

**E. Sheet Revision Block**

Sheet revision block, including space for sequential numbers, designer's name and date, description, and "approved by" name and date.

**F. Bluestake Logo**

A Bluestake logo with current phone number shall be on each sheet.

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G. Notes

Applicable sheet specific notes.

5.3.2 Content Requirements, Cover Plan Sheet

The cover sheet is the first sheet of the water plan. It shall include all requirements of paragraph 5.3.1 of this section and shall also include:

A. Project Name Block

The project name shall be located top center

B. Signature Block

Approval signatures are acquired from the City of Eloy Public Works Department. Also, approval signatures are acquired from the fire suppression authority for fire flow rates and duration and hydrant and fire service locations. Approval signatures are located in the signature block.

C. Other approval signatures

Other approval signatures may be required from other regulatory agencies (depending on the nature and location of the project) including but not limited to, Pinal County Department of Transportation, Arizona Department of Transportation, etc. These approval signatures are located adjacent to the top of the title block.

D. Physical Site Address

The physical site address is the official assigned address by Pinal County.

E. Location Map Requirements

The location map, (also known as the vicinity map) shall be located in a dedicated area in the top right corner of the cover sheet and shall be labeled "Location Map." The Location Map shall cover a minimum of one square mile at a scale of 3" = 1 mile or shown on a dedicated area on the cover, not to exceed 7" (H) x 6" (W) at an appropriate scale, and shall include:

- "This Project" arrow showing the project centered in the map.
- Existing conditions such as major streets, watercourses, and
- Surroundings that may affect the project
- Section, township, range, section corners, north arrow, and scale
- A text label identifying the political subdivision, such as City of Eloy ward, County Supervisor district, or other.

F. Sheet Index Plan Content Requirements

1. Sheet Index Plan

A sheet index plan shall be included on the cover sheet that shows a plan view (overhead, bird's eye view) of the entire project on one sheet.

2. General Items

General items, all to be labeled, include:

- a. North arrow, scale. (typically up or left direction)
- b. Water service area boundary, if near the project area
- c. Sheet index number arrows

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- d. Project boundary line
  - e. Project beginning and ending location
  - f. Project phase lines
  - g. Section, township, range; and section corners and quarter section corners
  - h. Legend, if unique to the site plan
  3. Existing and Proposed Mains and Structures  
Where the existing system is within or affected by the new project, show the location and size of existing and proposed water mains including protected mains, labeled as such. Also include valves and fire hydrants, and the location and name of existing and proposed waterworks structures.
  4. Major Streets, Water Courses  
Show existing or proposed major streets and all watercourses including any 100-year flood limits.
  5. Pressure Zone Boundaries  
Show pressure zone boundaries, with closed valves, if within the water sheet index plan sheet.
- G. Plan Number
1. Source  
A plan number will be assigned for each project by the City Engineer.
  2. Usage  
All project documents shall include a reference to the project using the City of Eloy project plan number.
  3. Location  
The Plan number shall be located on the upper right-hand corner, vertically, inside the border of the plan so that the number terminates at the upper right corner of the sheet.
- H. System Schematics and Information (Plant Design only)
1. Water System Schematic  
A water system schematic diagram will be shown on the cover sheet. The schematic diagram shall show the water service areas adjacent to the new facility, including the High Water elevations of these water service areas. In addition, it will show the new facility and site elevation schematically linked to the adjacent water service areas.
  2. Pump and Motor Requirement Table  
A pump and motor requirement table will be shown on the cover sheet. This table will include the following information for each pumping unit of the new facility:
    - Design Capacity
    - Design Total Dynamic Head
    - Minimum Shut-Off Head
    - Voltage
    - Phase
    - Minimum Horsepower

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3. Pump Settings

A table of pump settings will be on the cover sheet for applicable projects and will show the pressure setting in pounds per square inch for the on and off point for each pump of the new facility.

I. Construction Notes

1. General Construction Notes

General construction notes found in SD-100 in the City of Eloy Supplemental Standard Specifications and Details apply to all projects and are not to be included on the plans, other than those required herein.

2. Additional Construction Notes

Additional construction notes shall be located to the left side of the sheet, and labeled "Additional Construction Notes."

- a. Include, as the first note, the entire text contents of Note No. 1, found in SD-100, Construction Notes.
- b. A list of additional construction notes to be included on the plans shall be requested from the City of Eloy Public Works Department.
- c. Do not include construction notes that are already in the General Construction Notes, other than those required above.
- d. Do not include additional notes that are not applicable to the project.

J. Sheet Index List

The Sheet Index List, sometimes referred to as the Plan or Drawing Index List, is a list containing sheet numbers and corresponding sheet subtitles used in the plans. This list shall be labeled "Sheet Index List."

K. Legend

1. Include all symbols used on the plans for the project. Use only the standard water plan symbols as provided in MAG SD-110 and Exhibit 5-1 which serves to supplement the MAG standards.

L. Abbreviations List

- Include all abbreviations used on the plan sheets for the project.
- Do not include abbreviations that are not applicable to the project.

M. Site Grading and Enclosure Plan (Plant Design only)

The second sheet of the water plans for plant design projects shall be titled Site Grading and Enclosure Plan and shall include at a minimum the following:

- General Facility Layout
- Facility Tie-in to Existing Distribution System
- Property Boundaries
- Existing Topography
- Site Final Grade
- Perimeter Enclosure Location and Grade
- Drainage
- Site Access

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**5.3.4 Content Requirements, Standard Plan Sheets**

**A. Plan Sheet Content**

The plan sheets shall not include an aerial photographic background but will include the following:

1. Right-of-way dimensions and names, existing and proposed. State the recordation information, location, width and purpose, with street names labeled public or private.
2. Survey control line, including bearing and distance between control points, control points, and stationing.
3. Temporary project construction, utility, and private easements, including docket and page numbers
4. Approved City of Eloy survey benchmarks (NAVD 88 datum).
5. Property lines, lot addresses, block numbers, subdivision names, parcel numbers.
6. All physical obstructions which may influence the location of the new pipeline such as fences, curbs, sidewalks, edge of pavement, street lighting, major vegetation, and traffic control devices; and locations and elevations at inverts of sanitary sewers, storm sewers and other similar underground structures where applicable.
7. All appurtenances, structures or equipment and any utilities that may be found to exist having any potential impact on the project that will assist the Contractor in properly evaluating the obstructions and conflicts they may encounter during construction. Examples include:
  - Corrosion test stations, air release valve assemblies, drain valve assemblies, fire hydrants, all existing and future water main tie-overs, renewals, and abandonments,
  - Service taps, water meters, and water service lines,
  - Natural gas mains and gas services, gasoline lines,
  - Power and telephone poles to include lights and transformers,
  - Underground traffic signal loops, electric, telephone and television cables, fiber optics and conduits,
  - Sewers with base map number and manholes with invert elevations and house connection to sewer (if obtainable), and
  - Storm sewers.
6. Materials including fittings, valves, & appurtenances shall be called out in a suitable area near their location on the drawing and boxed with a tapered leader to the location on the drawing. Call out shall include stationing, offset, quantities and sizes.
7. Any utility proposed in the area of construction that will not be in place but will affect the water project installation will be marked "Proposed."
8. Water main horizontal alignment design deflections.
9. Match lines when more than one sheet is used.
10. Butterfly valve actuator stem placement south or west of main.

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B. Stationing

1. Alignment

Show stationing at each tie-in/connection location, valve, service connection, fire hydrant (at the tee), blow-off assembly, air relief valve, fitting, tee, horizontal deflection/ bend, corrosion test station, station equation, grade break, outlet, intersection centerline, etc.

2. Intervals

Show stationing at 100-foot intervals along the survey control line, identified at every station.

5.3.5 Profile Sheet Content

A. Profiles Required

In addition to plan views, pipeline profile views are required for all pipelines 12" in diameter or larger. At the request of the City Engineer, pipeline profile views may be required for mains less than 12" in diameter if necessary to depict stream, railroad or highway crossings, drainage structures, and utility congested areas. Additionally, profiles may be required regardless of pipe size for mains which are located outside of public road right-of-way where future grades could change significantly.

B. Restrained Joints

Show all restrained joints and required lengths in the profile view or in a properly labeled table.

C. Existing Grade Elevation

In the profile view, show existing grade elevation directly over proposed pipe alignment.

D. Stationing

Repeat the label information from the plan view in the profile view. Call out stationing at each valve, blow-off assembly, vertical fitting, tee, and grade break.

E. Slope

Show the slope of grade breaks in each pipe section to two decimal places, such as "+45.07%," calculated relative to the true length of the pipe. Label elevation at each grade break.

5.3.6 Content Requirements, Section and Detail Plan Sheets

These sheets shall contain only project specific sections and details.

All water plans depicting new mains in public or private road right-of-way shall include typical roadway sections with references back to the appropriate plan sheet. The typical section shall show the proposed water main as well as other proposed utilities with the appropriate dimensions.

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All project specific details, either for pipeline or water plant plans, shall be clearly presented, fully dimensioned, and drawn to scale where appropriate. For pipeline plans, any materials or methods related to a project specific detail that are not covered in the MAG Standard Details and Specifications or the City of Eloy Water System Development Standards shall be included as call-outs within the details or in the form of special notes on the Section and Details sheet.

DESCRIPTION	EXISTING	NEW
POTABLE WATER MAIN		
TEE AND CROSS		
BEND (HORIZONTAL)		
BEND (VERTICAL)		
FIRE HYDRANT		
FIRE PROTECTION SERVICE		
WATER VALVE		
BUTTERFLY VALVE		
CHECK VALVE (Arrow indicates flow direction)		
AIR RELEASE VALVE		
REDUCER		
DRAIN VALVE ASSEMBLY		
BACKFLOW PREVENTOR		
CASING FOR PIPE		
WELL WITH ID NUMBER		
PROTECTED WATER MAIN (Cover Sheet Only)		
WATER METER (Indicate size if not 3/4" X 5/8" service)		
BOOSTER PUMP STATION		
SURVEY MONUMENT		
END CAP		
CORROSION TEST STATION		

ISSUED:	<div>THE PLAN SYMBOLS PRESENTED HEREIN SUPPLEMENT STANDARD DETAIL 110 OF THE MARICOPA ASSOCIATION OF GOVERNMENTS STANDARD DETAILS FOR PUBLIC WORKS IMPROVEMENTS</div>		STANDARD WATER PLAN SYMBOLS EXHIBIT 5-1
MARCH 2007			
REVISED:			

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**6.0 WATER PLANT DESIGN STANDARDS**

**6.1 General**

**6.1.1 Purpose**

This section provides design standards and requirements for water plant projects in the City of Eloy which will be incorporated into the City water system. For the purposes of this document, the term “water plan” refers to a facility containing a production well, one or more storage reservoirs, a booster station, and all associated ancillary equipment and infrastructure.

**6.1.2 Applicability**

The design standards and requirements listed herein apply to all water plant projects.

**6.2 General Water Plant Requirements**

The requirements described below are based, in part, on ADEQ Engineering Bulletin No. 10.

**6.2.1 Preliminary Design Report**

A preliminary design report shall be submitted to the City Engineer for concept approval, which includes all of the items in the Water Plant Design Checklist (Exhibit 6-1).

**6.2.2 Site Requirements**

**A. Title of Property**

The property for a pumping station shall be conveyed in fee title to the City of Eloy. Property may be conveyed by plat, quit claim, or other instrument that results in a fee simple deed to the production site.

**B. Site Conditions**

The site shall meet at least one of the following conditions for access:

1. Have sixty feet or more of frontage directly along at least one public street having a right of way width of at least sixty feet.
2. Have an access easement of at least thirty feet in width from a public street to the site.
3. Access that has drainage problems, is unduly steep, or has conditions that limit access will not be acceptable unless remediated and approved by the City Engineer.

**C. Site Access**

Access shall be an all-weather road of not less than twelve feet in width, except that access roads, which exceed fifty feet in length, shall not be less than sixteen feet in width. An all-weather road is defined as an improved surfacing with drainage improvements as required. Improved surfacing will be gravel, chip-seal, asphaltic concrete, or concrete as determined by the City Engineer on a project-specific basis. All wash or drainage crossings shall be designed to allow crossing to be made under all weather conditions.

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D. Site Surface

Gravel surfacing of the interior of the site shall be required to provide reasonable access to all components of the pumping station.

E. Sanitary Control Distances

Sanitary control distances shall be as required by ADEQ.

F. Site Environmental Clearances

Sites being conveyed to the City of Eloy shall comply with all the following requirements:

- Archaeological Clearance
- Environmental Site Assessment Clearance
- Biological Assessment Clearance

G. Site Size and Shape

The pumping station site shall be of a sufficient size and appropriate shape to allow for all equipment and any necessary maintenance and repair activities. The typical water plant will also include storage and must be designed to accommodate the ultimate anticipated storage capacity for the area to serviced. Typical site dimensions for a booster and storage site are presented in Exhibit 6-1. Final approval of site size and shape shall be per the City Engineer's discretion.

H. Site Enclosures

All sites shall be enclosed. The security enclosure shall be completely located within the property boundary of the site. The acceptable enclosure will be as follows:

1. Masonry wall with a minimum height of seven feet, and:
2. One sixteen-foot (minimum) rolling drive-through gate and one three-foot walk-through gate. Gates shall be equivalent height as enclosure and shall be lockable.

I. Site Drainage

All sites shall be designed to allow for drainage of storm water and for any drainage of the pumping station for testing, maintenance, or repair.

1. Use drainage swales, curbs, culverts, storm sewers, or a combination thereof, as required, to provide internal site drainage.
2. If an offsite storm sewer or major drainage way is available, site drainage shall be collected before leaving the site.
3. The internal site collection system shall be sized to accommodate storm water as well as any additional water from testing of the pumping station or drainage for repairs.

J. Site Elevation

The site shall be located at an elevation above flood levels per ADEQ.

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K. Site Security Requirements

Project specific requirements for site security measures will be provided to the Design Engineer during the concept design phase of the project and may vary depending on site location and specific layout.

6.2.3 Pumping Units

A. General Requirements

Pumps shall be designed to maximize efficiency and flexibility of operation. Options may include:

1. Use of controls to alternate starts between pumping units,
2. Pumping units sized to meet flows and pressure requirements.
3. Use of variable speed controllers.
4. All pumps in a pumping station shall have the same discharge pressure, with due consideration for frictional head losses.

B. Type of Pumps

Vertical turbine pumps shall be utilized wherever practical. Other types of pumps, such as end suction centrifugal pumps, may be used at the discretion of the City Engineer.

C. Operations

1. Pump speeds shall be between 1,800 rpm to 3,600 rpm (nominal).
2. Minimum discharge pressure shall be in accordance with the City of Eloy's standard pressure zone requirements.
3. Pump operation shall be controlled by either pressure differentials as a function of demand or tank level of water storage facility.
4. Pressure sensing and pump control shall be in accordance with these standards.
5. Pumping units shall be controlled such that the unit is shut down and locked out of operations in either a low suction pressure condition, or a high discharge pressure condition.

D. Electric Motor Drivers

1. Electric motors shall be premium efficiency, three-phase, 480 VAC.
2. Electric motors shall be sized to accommodate the maximum design-operating load of the station pump without using the motor service factor.
3. The minimum service factor shall be 1.15.
4. Motor enclosures may be open drip proof, WP-1, or totally enclosed, fan cooled.
5. Motors of fifty horsepower or more shall have reduced-voltage starting.
6. Other requirements are discussed in Section 8 – Electrical Power and Controls.

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**E. Design Requirements**

For pressure-controlled sites, the pump shall be designed with an operating band of twenty pounds per square inch (nominal). The “on” position will be ten pounds per square inch below the designed operating pressure, and the “off” position will be ten pounds per square inch above the designed operating pressure. The actual pumping head at the “off” position shall not be less than ten feet below the total pump head on the specific pump curve at the far left point of the curve.

The vibration limit of a pump shall be as described in the Hydraulic Institute Standards, except that peak-to-peak vibration amplitude shall not exceed two mils for any frequency at any distance from base to point of measurement.

**6.2.4 Headers and Yard Piping**

**A. Definitions**

For clarification, the following terms shall be defined as follows:

“Suction Header” refers to the piping on the suction side of the station that distributes water to the suction laterals of the pumps.

“Suction Lateral” refers to piping from the suction header to the suction side of each pump. For vertical turbine pumps, this will also include the pump can.

“Discharge Header” refers to the piping on the discharge side of the pumping station that collects water from the discharge laterals of the pumping units.

“Discharge Lateral” refers to the piping from the discharge side of each pump to the discharge header.

“Yard Piping” refers to the below ground and suction and discharge piping on the pumping station site that connects the pumping station headers to the distribution system.

**B. Materials**

1. Above-ground piping shall be fabricated or mill type standard steel pipe in accordance with ASTM A53. Below-ground piping may be steel pipe, ductile iron pipe, or PVC, except that below-ground headers and laterals shall be steel pipe.
2. Ductile iron pipe and materials shall conform to the requirements of MAG 610 and 750 with the following fittings:
3. Flanges shall be Class 125 in accordance to ANSI B16.1 for operating pressures up to 250 pounds per square inch.
4. Nuts and bolts shall be Grade 316 stainless steel.
5. Gaskets shall be Grade 1 (rubber) or Buna N.
6. PVC pipe and fittings shall conform to the requirements of City of Eloy Standard Detail for PVC Pipe.

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7. Steel pipe and materials shall be fabricated or mill-type standard steel pipe in accordance with ASTM A53.

The minimum wall thickness shall be as follows:

Less than 5-inch diameter:	Schedule 40
6 to 10-inch diameter:	3/16-inch
12 to 24-inch diameter:	7/32-inch
16 to 30-inch diameter:	1/4-inch

8. Fittings:
- a) Flanges shall be Class 125, ANSI B16.1, for operating pressures up to 250 pounds per square inch.
  - b) Couplings utilizing grooves may be used in accordance with AWWA C606.
  - c) Above-ground fittings shall be flanged, welded, or coupled. Nuts and bolts shall be hot dip galvanized steel or epoxy painted.
  - d) Below ground fittings shall be welded or coupled. Nuts and bolts shall be Grade 316 stainless steel.
  - e) Gaskets shall be Butyl or EPDM.
9. Protective Coating:
- a) Internal coating shall be a three-coat, two-component catalyzed epoxy system. The epoxy system shall conform to all NSF requirements for potable water service. The minimum thickness shall be 12.0 dry mils, but in no case shall any individual coat be less than 4.0, nor more than 7.0 dry mil.
  - b) External coating for above-ground service shall be a two-coat, two-component epoxy system or a polyurethane system. The thickness of this coating system shall be between 6.0 and 9.0 dry mils. The first coat shall be between 4.0 and 6.0 dry mils, and the second coat shall be between 2.0 and 3.0 dry mils.
  - c) External coating for below-ground service shall be a factory-applied polyurethane system, as approved by Eloy Water.

**C. Piping System Design Requirements**

- 1. The flow velocity in suction headers shall not exceed three (3) feet per second.
- 2. The flow velocity in discharge headers shall not exceed five (5) feet per second.
- 3. Thrust restraint is required for all above-ground and below-ground pipe installation. Use restrained joints, welded joints, or joint harnesses for thrust restraint.
- 4. The design for use of flexible couplings shall allow for expansion, contraction, and maximized serviceability of equipment and will provide for a restrained joint.
- 5. Corrosion control of below-ground metallic pipe shall be in conformance with the professional standard of care used industry wide and as approved by the City Engineer. The City Engineer reserves the right to require a pre-design corrosion report prepared by a qualified corrosion expert.

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**D. Layout and Clearances**

1. As a minimum, five feet of clear space shall be provided from the outside of header piping to any wall, fence, or structure to provide adequate access to valves and fittings.
2. Provide adequate space for access between headers, laterals, pumps, motors, and other appurtenances to allow for maintenance and repair. Specific requirements will vary depending on physical layout and size of components.
3. Suction laterals from the suction header to the pump suction nozzle shall be as short and direct as possible. Reducers used in the suction lateral shall be eccentric reducers, with the flat side on top to reduce the potential for entrapped air in the suction lateral. The lateral angle from one end of the reducer to the other shall not be greater than fifteen degrees.
4. Yard piping shall be located in areas easily accessible for maintenance and repair. Piping will accommodate easy access by service truck.
5. Clearance between waterlines and sanitary sewers shall conform to the requirements set forth by ADEQ.

**E. Valves and Appurtenances on Header and Lateral Piping**

1. Provide an isolation valve on the suction and discharge lateral of each pump for isolation from the headers.
2. Provide a silent check valve on the discharge lateral of each pump, between the pump and the isolation valve to prevent reverse flow when the pump is off.
3. Provide a combination air-vacuum release valve on the high point of the suction header to release air trapped in lateral piping.
4. Provide a magnetic flow meter on the discharge header.
  - a) The flow velocity in the flow meter shall be in the range of one to fifteen feet per second for all designed flow conditions.
  - b) A minimum of five pipe diameters of clear, unobstructed piping shall be provided on each side of the flow meter, or as required by the manufacturer.
  - c) If the discharge header piping requires reduction in size to obtain the desired flow velocity, said reduction shall be by means of eccentric reducers placed outside of the five pipe diameter clear distance from each side of the meter, or as recommended by the manufacturer.
5. A test head lateral and isolation valve shall be provided off the discharge header for performance testing.
6. Provide sufficient taps as needed for pressure transducers, sample taps, dewatering, etc.
7. All isolation valves of four-inch diameter or greater on headers and laterals shall be butterfly valves.

**F. Valves and Appurtenances on Yard Piping**

1. Yard piping shall be of standard pipe size (i.e., 4-, 6-, 8-, 12-, 16-, 24-, 30-inch diameter).
2. Locate valves for ease of access and operation.

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3. Isolation valves shall be installed on piping entering and leaving the site to provide the ability to isolate the pumping station from the distribution system.
4. Underground valves from four- to twelve-inch in diameter shall be gate valves.
5. Underground valves from sixteen- to thirty-inch in diameter shall be butterfly valves.
6. A sample spigot shall be provided from the discharge side of the pumps. The sample tap should be located on the pumping station site, just prior to entry into the water distribution system.

**6.2.5 Hydro-pneumatic Tanks**

**A. Design Requirements**

1. With regards to the design and operation of hydro-pneumatic tanks, the following shall be considered:
  - Operating Pressure Range
  - Pumping Range
  - Water Seal Over the Tank Outlets
  - Pumping Cycles per Hour
3. Standard tank size shall be 5,000 gallons for a regional facility.
4. No portion of the hydropneumatic tank shall be buried.
5. Protective coatings shall be NSF approved for potable use.
6. Specifications shall include tank capacity, dimensions, appurtenances, pressure rating, disinfection procedures, and air compressor capacity.

**B. Tank Appurtenances**

1. Tanks shall have isolation valves such that they can be isolated from the rest of the pumping station.
2. Tanks shall be equipped with an air compressor and shall be automated to maintain proper water and air volumes within the tank. Additional items include a stilling well and magnetic switches for air compressor controls, and for low suction alarm.
3. Tanks shall also be equipped with:
  - A pressure relief valve
  - A pressure gauge
  - A bottom drain and valve to completely drain the tank.
  - An access port for personnel entry to perform inspections.
4. Tanks shall be equipped for installation of a pressure pedestal.
5. Tanks shall have two lifting lugs on top of each tank.

**6.3 Water Storage Facility Requirements**

**6.3.1 Site Elevation and Grading**

The site shall be located at an elevation above floodplain per ADEQ. Grading shall be designed to ensure proper drainage away from the reservoir at all locations.

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**6.3.2 Types of Water Storage Reservoirs**

The type of reservoir will depend on various factors including but not limited to, size, location, environmental and neighborhood concerns.

**A. Above-Ground Storage**

**Welded Steel Reservoir**

Welded steel tanks shall conform to the most current revision of AWWA D-100. In general, acceptable sizes for welded steel tanks will range from 1.0 million gallons to 2.0 million gallons in capacity.

**Pre-Stressed Concrete Reservoir**

Pre-stressed concrete tanks shall conform to the most current revision of AWWA D-10. In general, acceptable sizes for pre-stressed concrete tanks will range from 1.0 million gallons to 2.0 million gallons in capacity.

**B. In-Ground Storage**

**Reinforced Concrete Reservoirs**

In general, Reinforced Concrete Reservoirs will range from 2.0 million gallons to 20.0 million gallons in capacity.

**6.3.3 Reservoir Design Requirements**

**A. Above Ground Storage**

1. Provide one or more inlets for each reservoir. The inlet shall be located in the side wall of the tank and at least 45° from the reservoir outlet. The inlet may be located at the top or bottom of the tank wall depending on the system conditions or requirements.
2. On single reservoir installations, provide an outlet located at least 45° from a tank inlet. On outlets which provide suction supply to station pumps, the outlet piping shall be equipped with an internal 90° fitting turned downward to prevent development of a vortex. The fitting shall be a ductile iron flange and flare; a ductile iron 90° long radius elbow; or a welded steel mitered fitting. Outlets shall have a minimum of twelve-inch clearance from the reservoir floor.
3. Provide an internal overflow weir inlet with an external overflow pipe. The overflow assembly shall be sized to handle the maximum tank inflow rate with a maximum water level rise over the inlet weir of six-inches. The overflow
4. discharge pipe shall terminate above ground, not be subject to submergence, and be fitted with a hinged flap valve or other approved check valve. The top of the overflow weir shall be a minimum of one-foot below the bottom of any roof rafter.
5. Provide one or more drains. The drains shall not be less than four-inch diameter and shall include an isolation valve. It shall be located a minimum practical distance above the tank floor.

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6. Provide one or more air vents located at or near the center of the roof, at the highest point practical. Vents shall be sized to prevent unacceptable atmospheric pressure changes for the maximum influent and effluent rates. Only the effective (net) screen opening area shall be considered for required airflow. Vents are to be double gooseneck type with the openings protected by 316 Stainless Steel Screen, 16 mesh.
7. Foundation:
  - a) Welded Steel Reservoir

The tank shall be supported by compacted aggregate base course on compacted native soil. The top of the foundation shall be at least eight inches above finished grade of the yard. (The compacted material shall be contained by a reinforced concrete foundation ring as required by detailed design.) Additional reinforced concrete pads may be required for center ring or columns as determined by detailed design. The tank floor shall be sloped downward at least one-inch vertical to every ten-foot horizontal from the tank center to the outside edge.
  - b) Pre-Stressed Concrete Reservoir

The foundation shall be designed by a professional structural engineer registered in the State of Arizona, and the design shall be based on a site-specific geotechnical report.
8. Access:
  - a) Ladders

Provide an exterior ladder extending to the full height of the tank. The exterior ladder shall comply with all OSHA Standards including safety cage and landings as required. Provide an interior ladder. The interior ladder shall be offset from the exterior ladder by at least two feet.
  - b) Roof Guard Rails

Provide handrails along the roof edge for a minimum distance of ten feet on both sides of the exterior ladder and a minimum of five feet on both sides of any perimeter appurtenance.
  - c) Roof Hatch

The primary roof hatch shall have a minimum size of thirty-inches in diameter with a four-inch curb. The roof hatch shall have a hinged cover with a two-inch downward overlap and provisions for locking. The location shall be offset from the exterior ladder centerline over the interior ladder. A secondary roof hatch shall be located over the tank overflow.
  - d) Walkways

Provide non-skid walkways on the roof of steel tanks to allow safe access to any appurtenance.
  - e) Shell Manholes

Welded Steel Tanks. Provide at least two shell manholes. One manhole shall be thirty inches in diameter with a hinged cover in accordance with AWWA Standards. The second manhole shall be a forty-eight-inch by forty-eight-inch flush-type cleanout in accordance with API Standards complete with hinge or davit arm. Locate the manholes approximately 180° apart.

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**B. In-Ground Storage**

1. Provide one inlet per reservoir located near the top of the reservoir and at the opposite side of the reservoir from the outlet.
2. Provide the reservoir outlet connection through an outlet structure at the bottom of the reservoir with a minimum four-inch silt stop.
3. Provide an internal overflow weir with an external overflow pipe or drainage channel. Size the overflow assembly to handle the maximum reservoir influent rate with a maximum water level rise over the weir of six inches.
4. Provide one drain with an isolation valve. Make drain connection through the bottom of the reservoir and terminate in an open top concrete drain box connected to a storm sewer system or adequate site drainage swale.
5. One or more vents, as necessary, shall be located at the highest point of the reservoir wall or at or near the highest point of the roof. The vents shall be sized for the maximum influent and effluent rates. Only the effective (net) screen opening shall be considered to pass air flow. Vents shall be of the gravity-type with openings protected by 316 Stainless Steel screen, 16 mesh.
6. The foundation shall be designed by a professional structural engineer registered in the State of Arizona and design shall be based on a site-specific geotechnical report.
7. A reservoir underdrain system and/or leak detection and monitoring system may be required by the City Engineer.
8. Access
  - a) Stairs/Ladders

Provide an exterior stairway or ladder extending to the roof of the reservoir. Provide an interior stairway or ladder to access the interior of the reservoir.
  - b) Roof Guard Rails

Provide handrails according to OSHA standards along the edge of the roof.
  - c) Roof Hatch

The primary roof hatch shall be a minimum of 2'-6" by 10'-0", with a four inch curb. The roof hatch shall have a hinged cover with a two-inch downward overlap and provisions for locking.  
Additional roof hatches shall be required for sampling. These hatches shall be located at a minimum of one hatch centered over each quarter of the reservoir and shall be a minimum of eighteen inches square.
  - d) Walkways

Provide non-skid walkways on the roof to allow safe access to any appurtenance and to prevent damage to reservoir roof.

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**6.3.4 Pipe Design**

**A. Materials**

Piping shall be either standard steel pipe in accordance with ASTM A53 or ductile iron pipe in accordance with the requirements of MAG Sections 610 and 750.

**B. Piping Configuration**

1. Water storage facilities shall be designed with a separate inlet and outlet. The inlet and outlet shall be configured to minimize detention time of water.
2. The piping for water storage facilities that include a pumping station will be configured to allow the pumps to operate with the reservoir isolated from its source of supply.
3. Piping shall be configured to allow for any planned future facilities. This may include additional reservoir or an additional pumping station or station upgrade.

**6.3.5 Valves and Appurtenances**

**A. Isolation Valves**

1. A manually operated valve will be provided on the reservoir outlet piping to provide isolation of the reservoir.
2. Provide valves as required to isolate any major appurtenances to allow for future repair or replacement.

**B. Control Valves**

Provide control valves as required to allow for isolation of the reservoir with continued ability to use any associated pumping station and for isolation of any associated pumping station with continued ability to use the reservoir.

**C. Appurtenances**

Depending on system requirements, a flow meter may be required on the inlet and/or outlet of the reservoir. A staff gauge and water level indicator shall be provided to verify tank level on site.

**6.3.6 Leakage Testing**

All new reservoirs shall pass a leakage test prior to acceptance by the City Engineer. Testing requirements shall be clearly defined in the Special Specifications, and shall conform to the latest industry standard for the type of reservoir being tested (i.e.: AWWA for welded or bolted steel tanks; ACI for reinforced concrete reservoirs.)

**6.4 Electrical, Instrumentation and Control Requirements**

**6.4.1 Power**

For Electric Service and Electrical Distribution System requirements, refer to Section 8 - Electrical Power and Controls.

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**6.4.2 Instrumentation and Control**

For requirements for Process Control and Instrumentation, Field Devices, Motor Control Circuitry, Control and Instrumentation Compatibility, and Communications and SCADA, refer to Section 8 - Electrical Power and Controls.

**6.5 Disinfection Requirements**

The City Engineer will determine the requirements for disinfection systems on a case by case basis.

If a disinfection system is required based on the City Engineer's determination, the system will be designed to accommodate the specific needs of the water system.

**6.6 Electrical Power Back-Up Requirements**

**6.6.1 Purpose**

Production sites shall be equipped to provide a back-up source of power for emergency water production during unforeseen or scheduled electrical outages. The back-up power source will be reviewed and approved by the Eloy City Engineer on a case by case basis, and may include one of the following:

- Approved second circuit from power company
- Natural gas fired generator
- Diesel fired generator
- Combination drive

- A. Back-up power shall be supplied with an automatic transfer switch meeting all applicable codes and standards.
- B. Upon activation, the back-up power source will relay, via. SCADA, all run time and load information to a centralized water plant control system.

**6.6.2 Types of Back-Up Power**

Typical back-up power shall be comprised of an industrial quality combustion engine, 4 cycle, with radiator and fan cooled, rated for the full load of the production facility at 100% duty cycle. The AC generator shall be synchronous, four pole, 2/3 pitch, revolving field, drip-proof construction, single prelubricated sealed bearing, air cooled by a direct drive centrifugal blower fan, and directly connected to the engine with flexible drive disc. All insulation system components shall meet NEMA MG1 temperature limits for Class H insulation system and shall be UL1446 listed.

**A. Generator Set and Supplied Accessories Requirements**

- NEMA MG1 – As current version applies to alternators
- UL142 – Sub-base tanks
- UL1236 – Battery chargers
- UL2200 - Stationary Engine Generator Assemblies and Emergency Service

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**B. Generator Set with Digital Controls Types**

- The natural gas generator set with digital controls is the preferred generator type over diesel power.
- The diesel generator set with digital controls may be used in place of natural gas if it can be demonstrated that the cost to secure natural gas service cannot be accomplished for less than 50% of the cost of the generator set.

**C. Combination Drive**

Upon request and submittal of detailed engineering data and shop drawings to the Eloy City Engineer, a combination drive may be considered as a back-up source for powering production facilities. The combination drive shall consist of a vertically mounted electrical motor, and a horizontal combustion engine. This configuration may be considered in connection with deep wells or other vertical turbine pumps.

**6.7 Special Specifications**

A Special Specifications template which includes all elements of a regional water plant shall be requested in writing from the City Engineer near finalization of the plans. Said Specifications shall be redlined and modified by the Design Engineer to accommodate the specific project, and will become an integral part of the bid package once approved by the City Engineer.

**6.8 Exhibits**

Exhibit 6-1, Production Facility Design Report Outline

Exhibit 6-2, Typical Water Production Facility Layout (Single Reservoir)

Exhibit 6-3, Typical Water Production Facility Layout (Single Reservoir)

Date: \_\_\_\_\_

**PRODUCTION FACILITY DESIGN REPORT OUTLINE**

Project Name: \_\_\_\_\_ Sec. \_\_\_\_\_, T \_\_\_\_\_S, R \_\_\_\_\_E

Consultant: \_\_\_\_\_

Project Manager \_\_\_\_\_

**I. Introduction**


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- ☐ Design new station to serve new development.
- ☐ Provide Additional Capacity due to Increased Demand.
- ☐ Provide Additional Capacity for Fireflow Requirements.
- ☐ Upgrade Obsolete Equipment.

**II. Design Criteria**

- A. Suction Zone \_\_\_\_\_ Discharge Zone \_\_\_\_\_
- B. Station Capacity \_\_\_\_\_ (Initial) \_\_\_\_\_ (Future) \_\_\_\_\_
- C. Well Equipment Capacity \_\_\_\_\_
- D. Static Discharge Pressure \_\_\_\_\_
- E. Static Discharge HGL \_\_\_\_\_
- F. Site Elevation \_\_\_\_\_

**III. Pump Sizing And Number**

- A. Number of Pumps \_\_\_\_\_ (Initial) \_\_\_\_\_ (Future) \_\_\_\_\_

B. Pumps	1	2	3	4	5	6
Capacity:	_____	_____	_____	_____	_____	_____
H.P.:	_____	_____	_____	_____	_____	_____

C. Type of Pumps: (Indicate fire flow pumps using superscript FFP)

- ☐ Can type vertical turbine  
☐ Wet pit vertical turbine  
☐ Horizontal centrifugal  
☐ Other \_\_\_\_\_

IV. Plant Piping

- A. Suction Header Size \_\_\_\_\_, Velocity (ft/sec) \_\_\_\_\_ @ \_\_\_\_\_ GPM  
B. Discharge Header Size \_\_\_\_\_, Velocity (ft/sec) \_\_\_\_\_ @ \_\_\_\_\_ GPM

V. Storage

- A. Capacity \_\_\_\_\_ B. Peak Inflow/Outflow \_\_\_\_\_ GPM

VI. Well

- A. Pump Capacity \_\_\_\_\_ ☐ Vertical Turbine  
☐ Submersible

VII. Surge Protection Provisions

- A. Discharge System \_\_\_\_\_ Suction System \_\_\_\_\_  
B. Other \_\_\_\_\_

VIII. Control Valves

- A. Throttling  
1. Size \_\_\_\_\_ Velocity \_\_\_\_\_ ft./s \_\_\_\_\_ Capacity \_\_\_\_\_  
2. Suction Piping \_\_\_\_\_ inches, Pressure \_\_\_\_\_ psi  
3. Discharge Piping \_\_\_\_\_ inches, Pressure \_\_\_\_\_ psi  
B. Isolation ☐  
C. Actuator  
☐ Motor  
☐ Air  
☐ Hydraulic

☐ Other \_\_\_\_\_

**IX. Pump Station Data Logging and real Time Control (DL/RTC)**

**A. Station Controller**

- ☐ Allen Bradley PLC  
☐ Other \_\_\_\_\_  
☐ None

**B. Communications**

- ☐ 440 MHz Radio Requiring Frequency Coordination  
☐ Broadband Radio  
☐ Other \_\_\_\_\_

**C. Method of Controlling Booster Pumps**

- ☐ Tank Level  
☐ Discharge Pressure  
☐ Remote Manual  
☐ Local Manual Only  
☐ Other \_\_\_\_\_

**D. Method of Well Control (Combination Tank level and Demand)**

- ☐ Tank Level  
☐ Discharge Pressure  
☐ Remote Manual  
☐ Local Manual Only  
☐ Other \_\_\_\_\_

**E. UPS power required:** Yes ☐ No ☐

**F. Flow Meter Type:**

- ☐ Venturi                      ☐ Ultrasonic                      ☐ Propeller  
☐ Magnetic                      ☐ Ave. Pitot Meter                      ☐ Other \_\_\_\_\_

**X. Electrical Service**

**A. Power Co.** \_\_\_\_\_

**B. Power availability at site:** Yes ☐ No ☐

C. Line extension required: Yes ☐ No ☐

D. Contact name for new service \_\_\_\_\_

E. Voltage/Phase \_\_\_\_\_/\_\_\_\_\_

XI. Site Lighting

☐ Area

☐ Building

☐ None

XII. Site Security

☐ Gate Intrusion

☐ Building Intrusion

☐ Reservoir Intrusion

☐ Other \_\_\_\_\_

XIII. Accessory Equipment

☐ Blowers

☐ Aerators

☐ Sample Pumps

☐ Service Water Pumps

☐ SUMP Pumps

☐ Air Compressor

☐ Other \_\_\_\_\_

XIV. Disinfection Type

A. Storage \_\_\_\_\_

B. Booster Discharge \_\_\_\_\_

C. Dosage \_\_\_\_\_ MG/L (PPM) Cl<sub>2</sub> Demand \_\_\_\_\_

D. Usage (@ Max Flow) \_\_\_\_\_ (PPM) Cl<sub>2</sub> Residual \_\_\_\_\_

E. Control Method

☐ On / Off \_\_\_\_\_

☐ Flow Pacing \_\_\_\_\_

☐ Compound \_\_\_\_\_

F. Chlorine ☐ Ammonia ☐ PPG ☐

XV. Sanitation Facilities

- ☐ Basin
- ☐ Toilet
- ☐ Shower
- ☐ Sewer
- ☐ Septic
- ☐ Other \_\_\_\_\_

XVI. Architectural

- A. Screening
- B. Sound Control
- C. Landscape
- D. Building
  - 1. Metal
    - a. Instrumentation & Controls
    - b. Electrical Control
    - c. Disinfection
    - d. Pumps
    - e. Climatic Control
      - 1. Insulation
      - 2. Forced Ventilation
      - 3. Air Conditioning
  - 2. Masonry Building
    - a. Footprint Size \_\_\_\_\_
    - b. Instrumentation & Control
    - c. Electrical
    - d. Disinfection
    - e. Pumps
    - f. Climatic Control
      - 1. Insulation
      - 2. Forced Ventilation

### 3. Air Conditioning

#### XVII. Safety Equipment

- ☐ Safety Shower
- ☐ Eyewash
- ☐ Air Packs

##### A. Signs

- ☐ Auto Stat Equipment
- ☐ High Voltage Warning
- ☐ Danger Chlorine
- ☐ Hearing Protection Required
- ☐ Safety Glasses Required

##### B. Disinfection System Ventilation

- ☐ Forced Ventilation
- ☐ Not Required
- ☐ Other \_\_\_\_\_

##### C. OSHA Paint Scheme Requirements

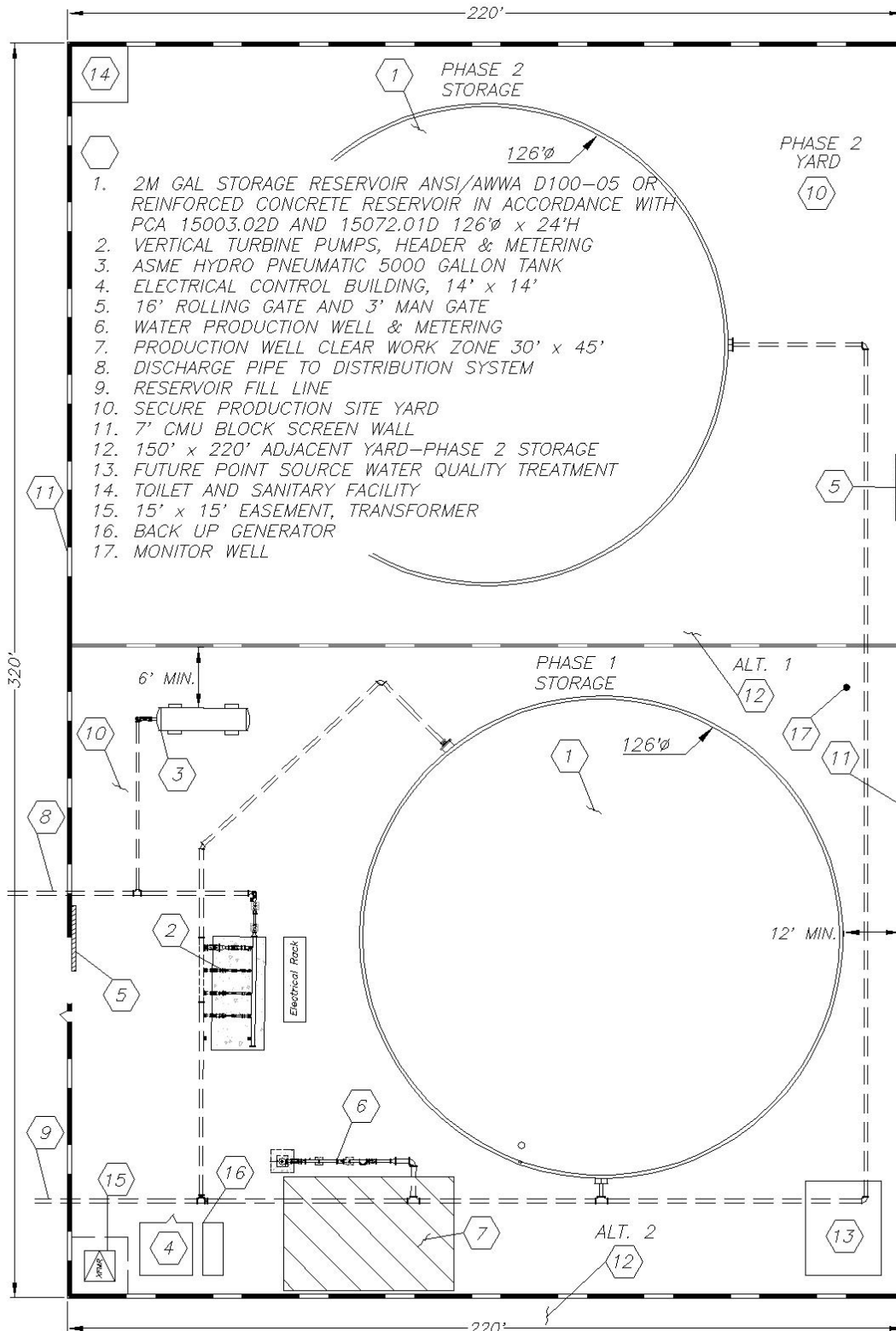
1. Chlorine Lines Color \_\_\_\_\_
2. Ammonia Lines Color \_\_\_\_\_
3. Service Water Lines Color \_\_\_\_\_
4. Potable Lines Color \_\_\_\_\_
5. Reclaimed Lines Color \_\_\_\_\_
6. Air Lines Color \_\_\_\_\_
7. Safety Equipment Color \_\_\_\_\_

### Exhibit 6-2, Typical Water Production Facility Layout (Single Reservoir)



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**Exhibit 6-3, Typical Water Production Facility Layout  
(Phased Storage)**



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PRODUCTION WELL DESIGN STANDARDS**

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**7.0 PRODUCTION WELL DESIGN STANDARDS**

**7.1 General**

**7.1.1 Purpose**

This section describes the design standards and requirements production well installation projects which will be incorporated into the City of Eloy water system.

**7.1.2 Applicability**

The design standards and requirements listed herein apply to all production well projects.

**7.2 Well Water Production Casing And Drilling**

**7.2.1 Method of Construction**

Improvements shall consists of furnishing all plant, labor, equipment, material, and appliances as well as performing all operations including drilling, casing installation, gravel packing, cementing, disinfecting, developing, sampling, production testing, and alignment surveying associated with drilling a high capacity production well.

**A. Drilling**

Permanent high capacity water production wells will be designed by a qualified hydro-geologist with demonstrated design experience in similar geologic formations and in similar regions to Eloy. The design of production wells calls for a combination of establishing drilling, construction and testing procedures to obtain detailed geologic and hydrologic information. Construction of a typical well described by these Design Standards is outlined in AWWA Standard for Water Wells No. A100-97. Water supply wells will be drilled by the reverse rotary method. Materials used shall be in accordance with AWWA, API, and ASTM specifications unless modified herein.

**B. Surface Casing and Well Casing**

1. Surface casing shall be new pipe meeting or exceeding ASTM A53B specifications. Minimum thirty-two inch (32") diameter surface casing shall be set plumb and centered in an augered hole not less than twelve-inches (12") greater in diameter than the surface casing. The surface casing setting will be approximately forty feet (40') below ground surface. A continuous, unbroken concrete grout envelope of as uniform a thickness as practical shall be placed in the annular space between the borehole wall and the surface casing. The grout envelope shall ensure the surface casing is entirely sealed against infiltrating surface waters
2. The well casing and screen shall be manufactured such that tensile, column and collapse strengths are sufficient to withstand column loads and bore hole pressures anticipated for well construction as specified herein. The Contractor shall submit to the City Engineer the specifications and engineering certification (mill certificates) for casing and well screen

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intended for use under this contract. Water levels in the open borehole must not fall below the bottom of the surface casing during installation of the well casing. Only clean water shall be used to maintain the fluid level in the open borehole during casing installation.

**7.3 Production Well Requirements**

**7.3.1 Site Layout Design Requirements**

**A. Site Layout**

The site layout shall be designed in accordance with the Water Plant Design Standards Section 6.

**B. Well Location**

Locate the well a minimum of forty feet from the water production facility enclosure (wall or fence, etc.) at the point of access. Provide a thirty-two foot by forty-five foot open area on the quadrant of the well site as indicated in Exhibit 7-1 for laying out column piping during pump removal and installation.

**C. Location and Appurtenances**

See Exhibit 8-1 for a well site general arrangement. The location of control buildings, hydro-pneumatic tanks, transformers, and any other appurtenances shall remain clear of the open area.

**D. Encroachments and Obstructions**

No site boundary, public street right-of-way, utility easement, or power company aerial easement shall encroach on the area within forty feet in front of the well and twenty feet on either side of the well. No physical obstructions on the site shall be within this area.

**E. Above-Ground Clearances**

With the exception of well discharge piping, all plant equipment, fences, plant structures, and above-ground piping shall be at least thirty feet from well.

**F. Discharge Piping**

See Exhibit 7-1. Locate well discharge piping at a right angle to the direction of well access opposite the open area.

**7.3.2 Piping, Valves and Appurtenances**

**A. Piping General**

1. The piping system shall be designed in accordance with the Water Plant Design Standards Section 6.
2. The piping shall be designed so that the well will discharge directly into the system or a reservoir.
3. Wells with a direct connection into the distribution system shall be disinfected according to ADEQ and Eloy Water requirements.
4. The above-ground discharge piping shall be fabricated steel or mill type standard steel pipe in accordance with ASTM A53.
5. The above-ground discharge piping shall be fabricated steel or mill type standard steel pipe, ductile iron pipe, or PVC pipe.
6. The above-ground discharge piping shall include piping, check valves, butterfly valves, flex couplings, flow meters, test tees, and other above ground discharge piping appurtenances required for a complete

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installation. See Exhibits 7-1 and 7-2 for a typical above-ground discharge piping configuration.

7. The discharge piping shall be sized for proper operation of the check valve and water meter. Normal velocities should be five (5) feet per second.
8. Put a sample tap and an air release valve up-stream the check valve.
9. Put a pressure gauge between the check valve and flow meter.
10. Put a length of ten pipe diameters of straight pipe leading into the flow meter and a minimum length of five pipe diameters of straight pipe downstream of the flow meter or install in accordance with the meter manufacturer's recommendations, whichever is greater.
11. Provide a well test tee downstream of the flow meter.

**B. Fabrication of Steel Pipe Requirements**

1. Steel pipe shall be fabricated steel pipe or mill type standard steel pipe in accordance with ASTM A53. The minimum wall thickness shall be as follows:

Less than 5-inch diameter:	Schedule 40
6 to 10-inch diameter:	3/16 inch
12 to 14-inch diameter:	7/32 inch
16 to 30-inch diameter:	1/4 inch
2. Fittings:
  - a) Flanges shall be Class 125 in accordance with ANSI B 16.1 for operating pressures up to 250 pounds per square inch.
  - b) Above-ground fittings shall be flanged, welded, or coupled. Nuts and bolts shall be hot dip galvanized steel or epoxy painted.
  - c) Below-ground fittings shall be welded or coupled. Nuts and bolts shall be Grade 316 stainless steel.
  - d) Gaskets shall be butyl or EPDM.
3. Protective Coating:
  - a) Internal coating shall be three-coat, two-component catalyzed epoxy system which shall conform to all NSF requirements for potable water service. The minimum thickness shall be 12.0 dry mils, but in no case shall any individual coat be less than 4.0 nor more than 7.0 dry mils.
  - b) External coating for above-ground service shall be a two-coat, two-component epoxy system or a polyurethane system. The thickness of this coating system shall be between 6.0 and 9.0 mils. The first coat shall be between 4.0 and 6.0 dry mils, and the second coat shall be between 2.0 and 3.0 dry mils.
3. External coating for below-ground service shall be a factory-applied polyurethane system.

**C. Ductile Iron Pipe and Materials**

- a) Ductile iron pipe shall conform to the requirements of MAG Sections 610 and 750.
- b) Flanges shall be Class 125 in accordance with ANSI B 16.1 for operating pressures up to 250 pounds per square inch. For operating

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pressures above 250 pounds per square inch, flanges shall be Class 250 in accordance with ANSI B16.1.

- c) Nuts and bolts shall be Grade 316 stainless steel.
- d) Gaskets shall be Grade 1 rubber or Buna N.

**D. PVC Pipe and Materials**

PVC pipe and fittings shall conform to the requirements of City of Eloy Supplemental Standard Detail SWD-1000.

**E. Piping System Design Requirements**

1. The discharge piping shall be sized for proper operation of the check valve and flow meter. Normal velocities shall not exceed five (5) feet per second.
2. Thrust Restraint
  - a) Design thrust restraint is required for all above-ground and below-ground pipe installation.
  - b) Use restrained joints, welded joints, or joint harnesses for thrust restraint. Reaction blocking and anchors will only be allowed for special conditions as approved by the City Engineer.
  - c) Design for flexible couplings to allow expansion, contraction, and maximum serviceability of equipment. Flexible couplings shall be designed to provide a restrained joint.
3. Corrosion control of below-ground metallic pipe shall be in conformance with the professional standard of care used industry wide and approved by the City Engineer. Locations of Isolating Joints (and therefore Type IV corrosion test stations) are required in the following locations: Changes in pipeline materials, i.e. ductile iron pipe, concrete cylinder pipe, welded steel pipe, and at inlet and outlet piping of plant facilities.
4. Layout and Clearances
  - a) Yard and piping shall be located in areas easily accessible for maintenance and repair.
  - b) Clearance between waterlines and sanitary sewers shall conform to the requirements set forth by ADEQ.

**7.3.3 Pumping Units**

**A. Pumps General**

1. Pumps may be either line shaft driven vertical turbine or submersible. Vertical turbine pumps are considered permanent in nature, while submersible pump installations may be used for interim well equipping.
2. The pump capacity shall be such that the run time shall be a minimum of two hours.
3. The pump should have adequate submergence to allow a pumping level decline for approximately seven-years based on historic regional decline data in the area.
4. The pump curve for the pump shall be as steep as practicable, and shall exhibit a continuously rising characteristic to shut-off head, with no points

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of zero slope reversal. The pump bowl's efficiency shall be as high as practicable.

5. Pump curves from the manufacturer annotated with the system curve and the proposed operational limits shall be submitted to the City Engineer for approval before installation of the pump.
6. The pump performance shall be measured at the pump discharge.

**B. Line Shaft Driven Vertical Turbine Pumps**

1. Vertical turbine well pumps shall be capable of operating at 150% of design head or shut-off head, whichever is less, for not less than two minutes without excessive vibration, binding, rubbing of rotating parts, or damage to the pump.
2. The column pipe assembly shall consist of column pipe, oil tube, line shaft, couplings, bearing and oil tube centralizing stabilizers (spiders). The inner-column (oil tube, line shaft, couplings and bearings) shall be manufactured to either Johnston new style or Peerless type dimensions and threading.
3. The column pipe and inner column shall be sized to have a column velocity of +/- 5 feet per second at the design point. The column pipe shall be furnished in interchangeable sections of a nominal length of ten feet.

**C. Submersible Pumps**

1. Submersible pumps may be used for interim equipping of deep water wells. In the event that a submersible pump and motor are elected, the Developer must also supply an approved note of assurance that a permanent vertical turbine pump and motor will be supplied and installed at no cost to the City of Eloy and on a schedule approved by the City Engineer.
2. The Pump Bowl shall be close grained Class 30 Cast Iron with smooth waterways.
3. Bowl assemblies shall have stainless steel shafts, polished bronzed impellers and bronze bearings
4. Submersible motor shall be of the vertical, submersible, squirrel cage induction type designed for continuous underwater operation.

**7.3.4 Pump Drivers**

In general, all pump drivers for new production wells shall consist of electric motors meeting the following general specifications:

1. Electric motors shall be three-phase, 480 volt.
2. Size electric motors to carry the full load of the well pump without using the motor service factor.
3. Motor enclosures may be open drip-proof, WP-1 or totally enclosed fan-cooled.
4. Motors of fifty horsepower or more shall have reduced-voltage starting.
5. Provide an anti-reverse ratchet for all vertical turbine pumps. .

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6. Motors should be selected to allow compliance or modification for consistent with current City of Eloy noise ordinances and abatement procedures.

**7.4 Electrical, Instrumentation and Control Requirements**

**7.4.1 Power**

For Electric Service and Electrical Distribution System requirements, refer to Section 8 - Electrical Power and Controls

**7.4.2 Instrumentation and Control**

For requirements for Process Control and Instrumentation, Field Devices, Motor Control Circuitry, Control and Instrumentation Compatibility, and Communications and SCADA, refer to Section 7 - Electrical Power and Controls

**7.5 Disinfection Requirements**

- A. The City Engineer will determine the requirements for disinfection systems on a case-by-case basis. Disinfection will be provided by one of the two following methods at individual well heads:
  - 1) Onsite generation of sodium hypochlorite using electrical current and sodium chloride (salt).
  - 2) Liquid feed system using bleach (12% sodium hypochlorite solution).
- B. The system will be designed to accommodate the specific needs of the water system as determined by the City Engineer.

**7.6 Special Specifications**

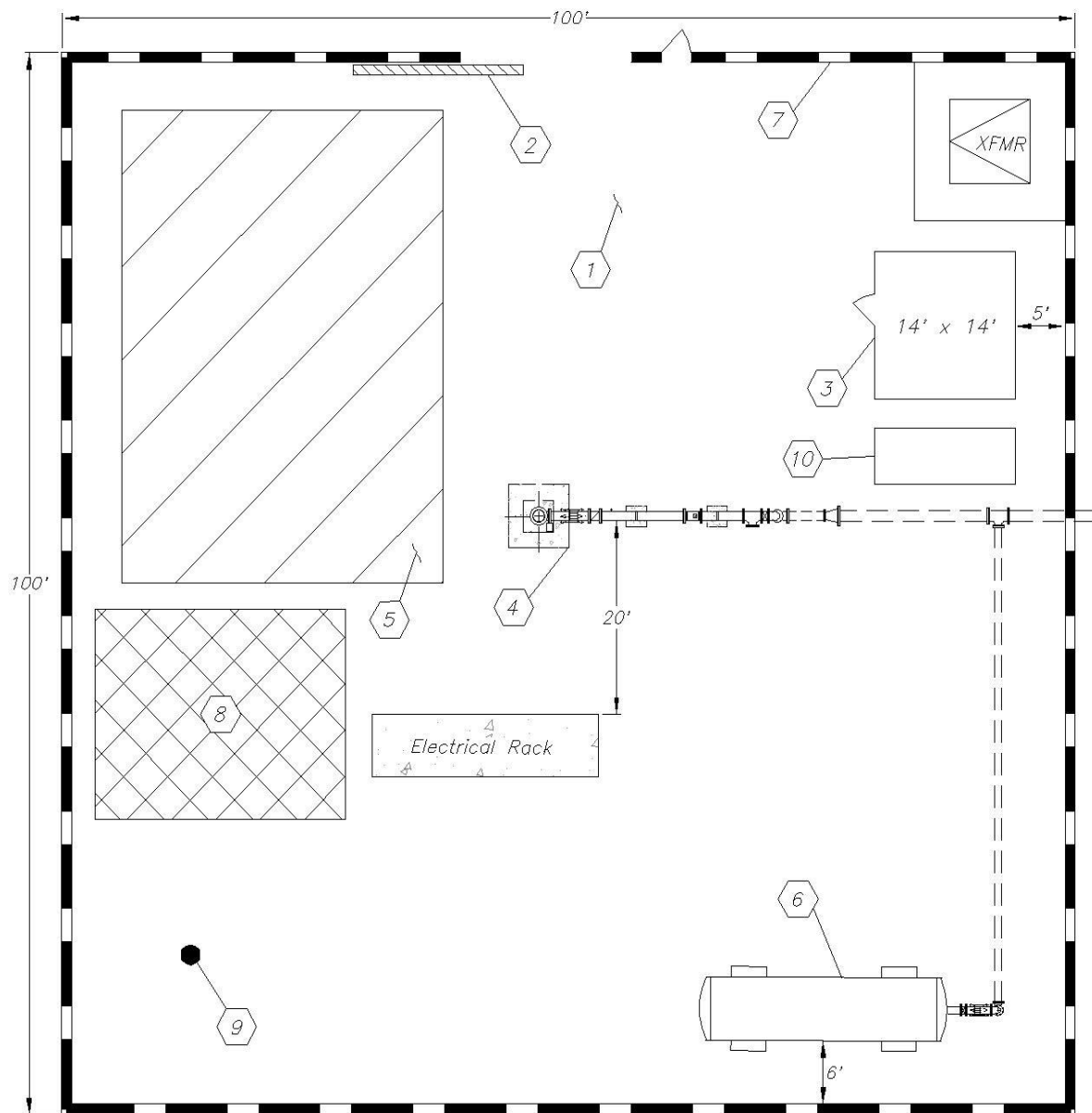
A Special Specifications template covering all aspects of production well installation and equipping shall to be requested in writing from the Public Works Engineer near finalization of the plans. Said Specifications will be redlined and modified by the Design Engineer to accommodate the specific facility, and will become an integral part of the bid package once approved by the City Engineer.

**7.7 Exhibits**

Exhibit 7-1, Example Layout of Typical Well Site  
Exhibit 7-2, Elevation View of Typical Well Installation

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Exhibit 7-1, Example Layout of Typical Well Site

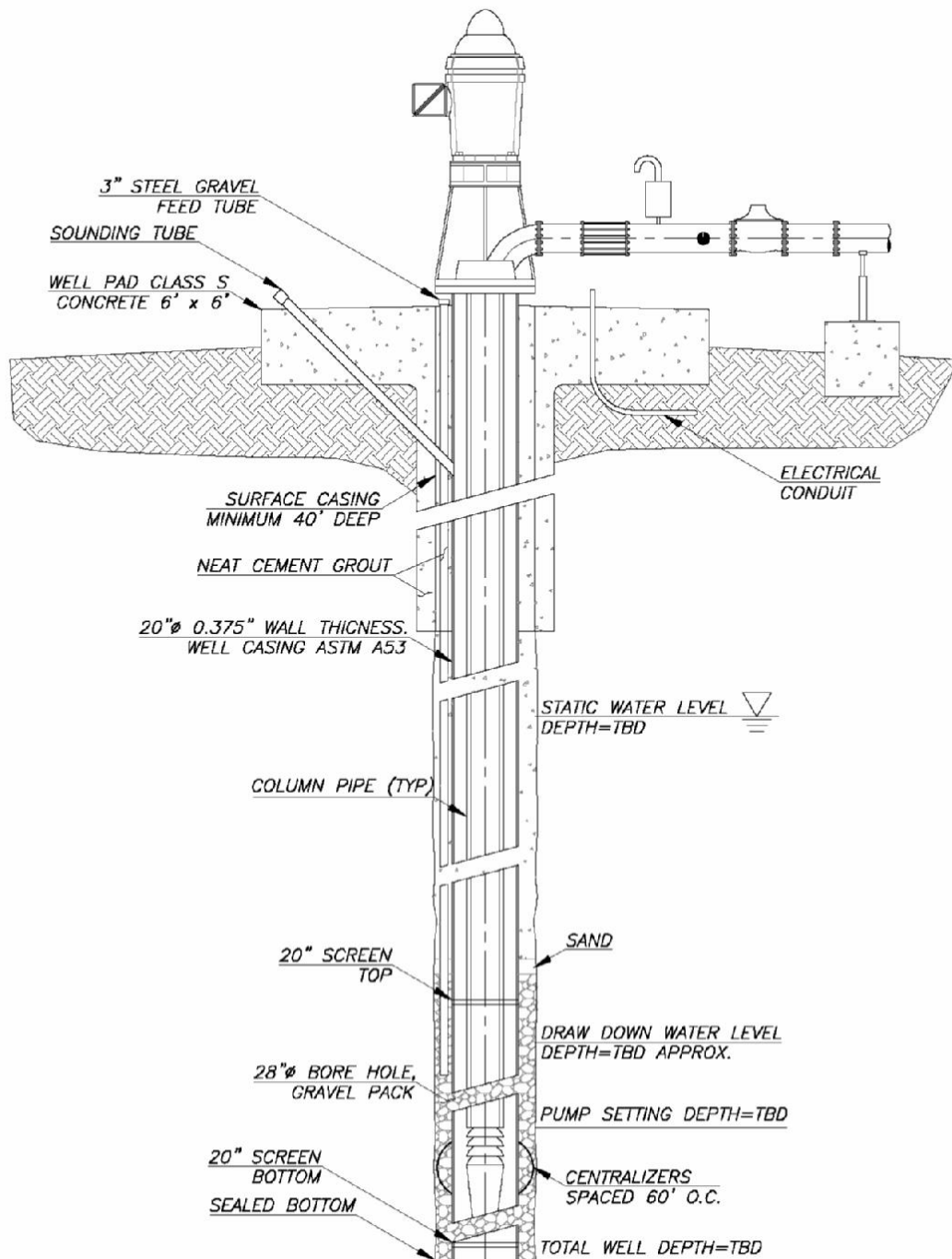


- PRODUCTION EQUIPMENT**
1. SECURE WATER PRODUCTION WELL SITE
  2. 16' ROLLING GATE & 3' MAN GATE
  3. ELECTRICAL CONTROL BUILDING
  4. WELL, WELL PUMP, PIPING & METERING
  5. WELL MAINTENANCE CLEAR WORKING AREA
  6. ASME HYDROPNEUMATIC 5000 GALLON TANK
  7. 7' CMU BLOCK WALL
  8. FUTURE POINT SOURCE WATER QUALITY TREATMENT
  9. MONITOR WELL
  10. BACK UP GENERATOR

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Exhibit 7-2, Elevation View of Typical Well Installation



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SECTION 8  
ELECTRICAL POWER AND CONTROL DESIGN STANDARDS**

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**8.0 ELECTRICAL POWER AND CONTROL DESIGN STANDARDS**

**8.1 General**

**8.1.1 Purpose**

This section describes the electrical power and control design standards and requirements for privately funded public water plant projects in the City of Eloy.

**8.1.2 Applicability**

The design standards and requirements listed herein apply to all developer-financed water plant projects.

**8.2 Electrical Power**

**8.2.1 Electric Service**

Electric service for City of Eloy facilities shall be designed for present and future loads. Service entrance equipment, conduit, conductors, grounding, short circuit protection, and overload protection shall be adequately sized for present and future loads, and shall meet electric utility design standards, NEC and applicable local electrical codes.

Provide integrated service and distribution system short circuit equipment rating in excess of that available from the electric utility.

Electric service ground electrode shall be proper length and size of copper wire per NEC, imbedded in concrete slab, with exothermic welds in concrete to copper stubs that connect above the slab to equipment enclosures. When a concrete slab isn't available then driven ground rods shall be used instead. Ground rods shall be copper clad steel with pointed end, 3/4 " in diameter and 10 feet in length.

Electric service shall be designed for three phase, 480 volt where available. Electrical service for 480 volt three phase typically consist of a single or multiple 480 volt three phase service disconnects. Single phase power and other service voltages may be acceptable depending upon City of Eloy facilities requirements.

Location of the service transformer and meter/current transformer cabinet may be either on or off City of Eloy property depending upon City of Eloy water plant and electric utility requirements.

Service meter and current transformers shall be provided by the electric utility. Connection of service entrance equipment and startup shall be coordinated between City of Eloy representatives , contractor and appropriate electric utility personnel.

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**8.2.2 Electrical Distribution System**

Distribution system electrical equipment, conduit, conductors, grounding, short circuit protection, and overload protection shall be adequately sized for present and future loads, and shall meet NEC and applicable local electrical codes.

Motor starter electrical/control schematics, electrical single line diagrams, conduit and wire schedules, appropriate electrical details, and detailed electrical specifications for all electrical equipment shall be provided for projects.

Electrical equipment on the load side of the meter/current transformer cabinet shall be owned and operated by City of Eloy.

Scaled site layout, scaled electric room/outside electric rack general arrangement and power distribution equipment shall be designed to minimize voltage drop, provide operation and maintenance ease and accessibility and meet space requirements in accordance with NEC. Top of equipment enclosures shall in general be mounted 6'-0" above final grade/final floor.

Power distribution equipment will typically be 480 volt three phase loads and 120/240 volt single phase loads.

Distribution equipment shall consist of motor control centers or pump control panels with motor starters, 240/120 volt circuit breaker panels, fused disconnect switches, 480-240/120 volt transformers feeding circuit breaker panels, wireways, conduit, etc. Reliability of the distribution system shall be a top priority. Include automatically resetting power failure monitor relays and surge protectors. Distribution equipment shall have durable nameplates on equipment enclosure exterior.

Motor control centers and pump control panels shall have elapsed time meters and motor running lights for booster and well pumps. Provide durable nameplates identifying all switches, lights, relays, terminal blocks, starters, etc.

Outdoor distribution equipment shall have NEMA 3R enclosure rating. Indoor distribution equipment shall have NEMA 1 enclosure rating. Distribution equipment in corrosive locations shall have NEMA 4X enclosure rating.

Indoor lighting shall be energy efficient fluorescent. Exterior lighting shall be compact fluorescent or low pressure sodium with fixtures that comply with light pollution codes, at the individual site locations.

Minimum conduit size shall be  $\frac{3}{4}$  inch. All conduit shall be schedule 40 PVC or rigid galvanized steel. All rigid galvanized steel conduit below grade shall be half wrapped with 10 mil PVC pipe wrap, including concrete encasement, to 1 inch above final grade. Buried conduit shall have a minimum burial depth of 24 inches.

Power and control wire shall be stranded copper, with XHHW insulation, 600 volt class, and minimum 14 AWG wire size. Instrumentation wire shall be stranded

**CITY OF ELOY, PUBLIC WORKS DEPARTMENT**  
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**ELECTRICAL POWER AND CONTROL DESIGN STANDARDS**

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copper, shielded twisted pair, 600 volt class, and minimum 16 AWG wire size. Each individual conduit shall have an appropriately sized equipment ground conductor inside, providing grounding continuity back to the electric service

Constant speed pump motor starters shall be full voltage across the line electromechanical starters for motors 40 hp and less. Constant speed pump motor starters shall be solid state soft starters for motors 50 hp and greater.

Variable speed pump motor starters shall be pulse width modulated, constant volt output per hertz, solid state variable speed drives.

### **8.3 Instrumentation and Control**

#### **8.3.1 General**

Process control and instrumentation at City of Eloy facilities shall have local and remote control at individual sites. Local control by personnel at the site shall override remote control at the site. Remote control shall operate by a programmable logic controller (PLC) in a remote terminal unit (RTU) cabinet at the site, with supervisory control of the PLC via unlicensed spread spectrum radio communications and a central SCADA site. Central SCADA site has a main PLC and operator workstation(s) which are used to control and monitor the remote sites.

Detailed piping and instrumentation diagrams (P&ID), appropriate instrumentation and control details, and detailed instrumentation and control specifications, for all instrumentation and control shall be provided for projects.

#### **8.3.2 Control and Instrumentation Compatibility**

Compatibility (same manufacturer and series of PLC) at the remote site PLC's and central site PLC shall be maintained. All control and instrumentation shall be compatible with and routed through PLC's located in RTU cabinet(s) either indoors or outdoors.

#### **8.3.3 RTU Cabinet and Programming**

RTU cabinet detailed design complete with drawings, fabrication, PLC programming, PLC program documentation, and control system startup shall be provided by the RTU cabinet supplier at individual sites. The RTU cabinet shall include a PLC, a UPS, assorted relays and terminal blocks, power supplies, spread spectrum radio that connects via coax cable to a yagi antenna, etc.

Programming format shall be similar to that already existing in the system. Central SCADA monitoring computer screens shall be programmed by the RTU cabinet supplier with input from City of Eloy representatives. Existing programming functions and displays shall be reused for the new sites where the required functions are the same as the existing functions. The system shall be programmed to allow adjustments of setpoints, such that as pump activation levels or pressures, from the existing central monitoring computer screen. Pump control shall be configured to restart multiple pumps in a sequential fashion on resumption of power after a power

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failure, to minimize total site electrical starting inrush current. Supplier shall coordinate with City of Eloy representatives on programming details of the system. The supplier shall develop all software on his/her own licensed development software off site, on his/her own computer equipment. Access time to the existing operating central computer system will be coordinated with City of Eloy representatives for downloading the debugged software. In order to prevent possible extended system problems during weekend periods, programming changes shall not be made on Fridays, and all modifications shall be coordinated with City of Eloy representatives two days before being performed. To assure quality, the supplier shall have successfully completed a manufacturer's sponsored training course on programming human-machine interface software prior to performing work.

**8.3.4 Well Pump Facilities**

Well pump facilities shall have the following instrumentation with appropriate range and span limits:

- Well discharge propeller flow meter and transmitter with 4-20 ma scaled flow rate output and scaled transistor open collector pulse total output; used for remote monitoring
- Well discharge pressure transmitter with 4-20 ma scaled pressure output; used for remote monitoring
- Well discharge high pressure switch with C form dry contact outputs, adjustable deadband, and adjustable pressure settings; used to shut the well pump motor off during high discharge pressure conditions, and for remote monitoring

Deep well turbine pump facilities shall have an automatically operated well oiler system that starts oiling the well pump line shaft when the well pump motor turns on and stops oiling when the well pump motor turns off. Well oiler shall be controlled by a normally closed solenoid valve in the oil line, that is opened and closed automatically via the well pump motor starter control circuit. Submersible well pump facilities shall not have an oiler system.

Deep well turbine pump facilities shall have a reverse spinback timer in the well pump motor starter control circuit, that prevents the well pump motor from restarting until after the well water column has completely fallen back to the water table. Typically the reverse spinback timer is set for greater than 3 minutes.

Well pump facilities that have sodium hypochlorite solution injecting into the discharge piping, shall automatically dose when the well pump motor turns on and stops dosing when the well pump motor turns off. Dosing shall be controlled by a chemical metering pump that starts dosing automatically via the well pump motor starter control circuit.

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**ELECTRICAL POWER AND CONTROL DESIGN STANDARDS**

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Well pump facilities that have backup power to run the well, when utility power is lost, shall have a diesel powered backup generator and an automatic transfer switch. Generator shall be sized large enough to properly start and run the well pump motor, in addition to required site power and control equipment. When utility power is lost the diesel generator shall start automatically and then the automatic transfer switch shall switchover to allow the generator to power the site. Generator status signals, such as generator running, utility power lost, etc, shall be monitored.

**8.3.5 Storage Tank and Booster Pump Facilities**

Storage tank and booster pump facilities shall have the following instrumentation with appropriate range and span limits:

- Booster discharge magnetic flow meter and transmitter with 4-20 ma scaled flow rate output and scaled transistor open collector pulse total output; used for remote monitoring
- Booster discharge pressure transmitter with 4-20 ma scaled pressure output; used for controlling which booster pumps are running based upon discharge pressure setpoints, and for remote monitoring
- Booster discharge high pressure switch with C form dry contact outputs, adjustable deadband, and adjustable pressure settings; used to shut the booster pump motors off during high discharge pressure conditions, and for remote monitoring
- Booster discharge hydro pneumatic tank air compressor system stainless steel stilling well with a magnetic float inside, on the side of the hydro pneumatic tank, that tracks the water level, and magnetic switches with C form dry contact outputs, on the outside of the stilling well that are used to turn the air compressor on and off based upon water level, and for tank high water level remote monitoring.
- Storage tank low pressure switch with C form dry contact outputs, adjustable deadband, and adjustable pressure settings; used to shut the booster pump motors off during low suction pressure conditions, and for remote monitoring
- Storage tank water level pressure transmitter with 4-20 ma scaled water level output; used for controlling wells pumping into the storage tank based upon tank water level setpoints, and for remote monitoring
- Motor operated valve position transmitter with 4-20 ma scaled valve position output, used for remote monitoring
- Motor operated valve open and close limits and local-remote switch with C form dry contact outputs, used for remote monitoring
- Motor operated valve open and close commands with dry contact inputs, used to automatically or manually open and close the valve to prevent storage tank from overflowing and for directing well water between different storage tanks

Booster pump facilities air compressor shall be automatically controlled to maintain a proper air cushion (water level) in the booster discharge pressure hydro pneumatic tank(s).

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**ELECTRICAL POWER AND CONTROL DESIGN STANDARDS**

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Booster pump facilities motor starters shall be either all variable speed drives or a combination of variable speed drives and constant speed starters. The discharge pressure transmitter, via the PLC program in the RTU cabinet, will control the drives and starters. Variable speed drive rated motors shall be used for the variable speed drives. The exact combination and sizes of constant speed versus variable speed pumps shall be determined after first analyzing the booster discharge system hydraulics.

Booster pump facilities that have backup power to run one or more booster pumps, shall be powered by diesel gas engines. The diesel powered gas engine pumps shall only turn on during utility electrical power failure and shall be controlled by a backup pressure switch in the discharge piping. The backup pressure switch shall have on and off pressure setpoints similar to the electric motor booster pumps.

The motor operated valve(s) shall have proper automatic operation from the central SCADA system, in addition to manual operation directly at the valve(s). The valve(s) shall automatically operate in a coordinated fashion with well(s), storage tank(s) water level(s), via the central SCADA system. The purpose is to minimize well(s) cycling on and off while keeping storage tank(s) full. The exact operating scenarios and control schemes for the motor operated valve(s) shall be determined after first analyzing the system hydraulics.

**CITY OF ELOY, PUBLIC WORKS DEPARTMENT  
SECTION 9  
STANDARD DETAILS & APPROVED MATERIALS**

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**SUPPLEMENTAL STANDARD WATER DETAILS**

SWD 100 .....	General Notes
SWD 110 .....	Water Service Notes
SWD 200 .....	Trench Detail
SWD 300 .....	Sewer/Water Crossing Details
SWD 400 .....	Water/Storm Drain Separation
SWD 500 .....	Air Release Valve Installation, 1" and 2"
SWD 600 .....	Drain Valve Assembly Installation
SWD 700 .....	¾" & 1" Single Meter Installation
SWD 750 .....	Split Water Service – Dual ¾" Meter Installation
SWD 760 .....	1 1/2" & 2" Single Meter Installation
SWD 800 .....	Joint Restraint
SWD 900 .....	Boring and Casing
SWD 1000 .....	PVC Notes
SWD 1100 .....	Right-of-Way Pipe Location

**APPROVED MATERIALS**

APPROVED MATERIALS LIST .....	9-29
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1. ALL CONSTRUCTION SHALL CONFORM TO THE MARICOPA ASSOCIATION OF GOVERNMENTS (MAG) UNIFORM STANDARD SPECIFICATIONS AND UNIFORM STANDARD DETAILS FOR PUBLIC WORKS AND TO THE CITY OF ELOY SUPPLEMENTAL STANDARD DETAILS. ALL WORK SHALL BE PERFORMED BY A CONTRACTOR LICENSED BY THE STATE OF ARIZONA AS DETERMINED BY THE ARIZONA REGISTRAR OF CONTRACTORS (A, A-12, A-16). A COPY OF ALL APPLICABLE DETAILS SHALL BE ON THE PROJECT SITE AT ALL TIMES WHILE WORK IS BEING PERFORMED.
2. PRECONSTRUCTION PROCEDURE:
  - A. ALL PLANS MUST BE APPROVED AND SIGNED BY THE CITY OF ELOY
  - B. WORK SHALL NOT COMMENCE UNTIL A WRITTEN "NOTICE TO PROCEED" HAS BEEN ISSUED BY THE CITY ENGINEER.
  - C. THE CONTRACTOR SHALL NOTIFY THE CITY ENGINEER A MINIMUM OF THREE DAYS IN ADVANCE OF CONSTRUCTION TO REQUEST A PRECONSTRUCTION MEETING ONLY AFTER RECEIVING APPROVED PLANS, AND THE "CERTIFICATE OF APPROVAL TO CONSTRUCT" FROM THE ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY AND THE SIGNED CONSTRUCTION AGREEMENT.
  - D. THE CONTRACTOR SHALL NOT COMMENCE PRIOR TO BEING ISSUED A NOTICE TO PROCEED.
  - E. THE CONTRACTOR IS RESPONSIBLE FOR OBTAINING ALL PERMITS REQUIRED TO COMPLETE THE WORK.
3. LAYOUT/CUT SHEET SUBMITTAL:
  - A. LAYOUT / CUT SHEETS SHALL BE SUBMITTED TO THE CITY ENGINEER AND VERIFIED PRIOR TO ISSUANCE OF "NOTICE TO PROCEED". THESE LAYOUT / CUT SHEETS SHALL SHOW ALL STATIONING AND CUTS FOR ALL VALVES, CONNECTIONS, HYDRANTS, SERVICES, FITTINGS, ETC. TO BE INCLUDED IN THE PROPOSED SYSTEM. ALL CUTS WILL BE TO PIPE INVERT. STATIONING MUST BEGIN AT A KNOWN PERMANENT POINT WHICH WILL REMAIN VISIBLE AFTER COMPLETION OF CONSTRUCTION. NO WORK IS ALLOWED IN AREAS THAT HAVE NO APPROVED LAYOUT / CUT SHEETS.
  - B. AN ARIZONA REGISTERED LAND SURVEYOR SHALL CERTIFY THAT THE ELEVATIONS ON THE SUBMITTED LAYOUT SHEETS ARE THE EXISTING ELEVATIONS AND PROPOSED FINAL GRADES AS OF THE DATE OF SURVEY. THE NEW MAIN SHALL HAVE NO LESS THAN 36" OF COVER DURING CONSTRUCTION.
  - C. CURVES WITH A RADIUS OF 300 FEET OR LESS SHALL BE STATIONED EVERY 25 FEET. CURVES WITH A RADIUS GREATER THAN 300 FEET SHALL BE STATIONED AT A MINIMUM OF 50 FOOT INTERVALS.
  - D. CUTS FOR THE END LOCATION OF SERVICES, FIRE HYDRANTS, AND FIRE HYDRANT OR FIRE SERVICE STUB OUTS SHALL BE SHOWN TO THE FINAL GRADE. STATIONING AND CUTS FOR THE FIRE HYDRANTS AND THE FIRE HYDRANT STUB OUTS SHALL BE SHOWN BOTH AT THE MAIN AND AT THEIR END LOCATIONS. STATIONING AND CUTS FOR SERVICES SHALL BE SHOWN AT THEIR END LOCATIONS.
  - E. CONSTRUCTION STAKING SHALL REFLECT THE INFORMATION SHOWN ON THE LAYOUT / CUT SHEETS. THE DISTANCE AND DIRECTION OF THE OFFSET LINES IN RELATION TO THE WATER LINES SHALL BE CLEARLY NOTED.
  - F. LOST OR DAMAGED OFFSET HUBS SHALL BE MAINTAINED AND IMMEDIATELY REPLACED IF LOST OR DAMAGED.
  - G. IF INVERTS ARE PROVIDED ON THE APPROVED PLANS, HUB ELEVATIONS FOR THE OFFSET LINE SHALL BE SHOWN ON THE LAYOUT / CUT SHEET.
  - H. THE OWNER SHALL REPLACE AT HIS OR HER EXPENSE ANY EXISTING SURVEY MONUMENTATION DAMAGED OR DISTURBED DURING CONSTRUCTION (INCLUDING PROPERTY PINS). THE REPLACEMENT SHALL BE MADE BY AN ARIZONA REGISTERED LAND SURVEYOR AND A RECORD OF SURVEY WILL BE REQUIRED.
4. THE CONTRACTOR SHALL COMPLY WITH APPLICABLE ARIZONA REVISED STATUTES PERTAINING TO "BLUE STAKE".
5. WATER MAINS SHALL BE INSTALLED AFTER SEWER INSTALLATION AND AFTER GRADING OF STREET AND WALK AREAS TO WITHIN 6" OF FINAL GRADE.
6. WATER MAINS SHALL BE INSTALLED WITH A MINIMUM OF 44" OF COVER FROM FINAL GRADE EXCEPT AS OTHERWISE NOTED ON THE APPROVED PLANS.
7. WATER MAINS INSTALLED WITHIN RIGHTS-OF-WAY THAT ARE NOT AT FINAL GRADE SHALL BE INSTALLED WITH A MINIMUM OF 60" OF COVER FROM THE FUTURE FINAL GRADE EXCEPT AS OTHERWISE NOTED ON THE APPROVED PLANS.
8. TERMS OF PAVEMENT CUTS SHALL BE OBTAINED FROM THE CITY ENGINEER. THE CONTRACTOR SHALL COMPLY WITH ALL TERMS FOR PAVEMENT CUTS.
9. THE BACKFILL MATERIAL, COMPACTION, AND PAVEMENT PATCH SHALL BE IN ACCORDANCE WITH MAG SECTION 6010R, PER THE WRITTEN DIRECTION OF THE CITY ENGINEER.
10. JOINT USE TRENCHES ARE ACCEPTED ONLY WITH THE WRITTEN AUTHORIZATION OF THE CITY ENGINEER. WHEN ELECTRIC, TELEPHONE OR GAS FACILITIES PARALLEL WATER FACILITIES, THEY SHALL NOT BE INSTALLED WITH LESS THAN 5' HORIZONTAL CLEARANCE FROM THE WATER MAIN.

ISSUED:

MARCH 2007

REVISED:



**SWD-100-1**  
**GENERAL NOTES**

11. ONLY APPROVED PLANS SHALL BE USED FOR THE INSTALLATION OF WATER FACILITIES. APPROVED PLANS REQUIRING REVISION SHALL BE APPROVED BY THE CITY ENGINEER PRIOR TO START OF REVISED WORK.  
CHANGES REQUIRING A REVISION:
  1. ADDING OR DELETING NEW WATER MAINS
  2. REROUTING OF NEW WATER MAIN GREATER THAN 12" FROM THE ORIGINAL LOCATION.
  3. ADDING, DELETING, OR RELOCATING OR CHANGING THE SIZE OF A NEW WATER SERVICE.
  4. ADDING, DELETING, OR CHANGING THE SIZE OF A NEW FIRE SERVICE.
  5. ADDING, DELETING, OR RELOCATING A NEW FIRE HYDRANT.
  6. CHANGING EASEMENTS
  7. CHANGE IN OWNER / DEVELOPER NAME
12. RECLAIMED WATER MAINS SHALL BE CONSIDERED THE SAME AS SEWERS WHEN INSTALLED WITHIN PROXIMITY OF A POTABLE WATER MAIN.
13. FIRE HYDRANTS SHALL BE SET AT CURB RETURNS, COMMON LOT LINES, OR AS INDICATED ON THE APPROVED PLANS, AS DIRECTED BY THE RESPONSIBLE FIRE AUTHORITY, AND IN ACCORDANCE WITH MAG STANDARD DETAIL 360.
14. THE OWNER/DEVELOPER SHALL HAVE ALL CURB STOPS LOCATED AND IS RESPONSIBLE FOR THEIR PROTECTION DURING ALL PHASES OF CONSTRUCTION UNTIL WATER METERS ARE INSTALLED. WATER SERVICES SHALL BE SET IN A FLAT STRIP OF LAND WHICH PARALLELS THE CURB, SIDEWALK, OR WATER MAIN. THIS 3' STRIP OF LAND SHALL NOT EXCEED THE TOP OF CURB OR SIDEWALK NOR BE BELOW THE BOTTOM OF CURB OR SIDEWALK. THE OWNER DEVELOPER SHALL BE RESPONSIBLE FOR PROTECTING ALL CURB STOPS DURING ALL PHASES OF CONSTRUCTION.  
NO METERS WILL BE RELEASED PRIOR TO FINAL ACCEPTANCE WITHOUT WRITTEN PERMISSION FOR THE CITY ENGINEER. PRIOR TO APPLYING FOR A METER, THE OWNER/DEVELOPER MUST LOCATE AND EXPOSE ALL CURB STOPS. IF THE CURB STOP IS NOT EXPOSED, THE METER WILL NOT BE INSTALLED AND THE APPLICANT MUST RESCHEDULE INSTALLATION. AFTER METER INSTALLATION THE OWNER/DEVELOPER IS RESPONSIBLE FOR THE PROTECTION OF THE METER AND METER BOX UNTIL THE ACCOUNT IS TRANSFERRED TO THE HOMEOWNER. ALL METER BOXES MUST BE INSTALLED ACCORDING THE PUBLISHED STANDARD SPECIFICATIONS AND DETAILS. METER BOXES BROKEN OR REMOVED BY THE CONTRACTOR WILL BE REPLACED OR RESET IN ACCORDANCE WITH THE CITY OF ELOY STANDARDS AT THE CONTRACTOR'S EXPENSE.
15. SET ANGLE METER STOPS 8" BEHIND BACK OF CURB IN STREETS WITH CURBS AND 8" BELOW FINISHED GRADE.
16. SET ANGLE METER STOPS 3' FROM PROPERTY LINE IN STREETS WITHOUT CURBS AND 8" BELOW FINISHED GRADE.
17. ANGLE METER STOPS SHALL NOT BE INSTALLED AT THE SAME LOT CORNER AS THE ELECTRIC SERVICE OR TRANSFORMER. WHERE THIS CANNOT BE ACCOMPLISHED, THE WATER SERVICE AND THE ELECTRICAL SERVICE OR TRANSFORMER MUST HAVE A MINIMUM HORIZONTAL SEPARATION OF 10'.
18. THE CONTRACTOR SHALL HAVE ALL WATER VALVES IDENTIFIED AND LOCATED PRIOR TO PAVING AND SHALL HAVE ALL VALVE BOXES SET TO FINAL GRADE AFTER PAVING IN ACCORDANCE WITH MAG SECTION 354.
19. ONLY IMPROVEMENTS SHOWN ON THE APPROVED WATER PLANS MAY BE INSTALLED AS PART OF THE PUBLIC WATER SYSTEM.
20. PASSING MICROBIOLOGICAL TEST RESULTS ARE REQUIRED PRIOR TO FINAL ACCEPTANCE. THE TEST IS THE RESPONSIBILITY OF THE CONTRACTOR; HOWEVER THE CHAIN OF CUSTODY MUST BE THROUGH THE AUTHORIZED CITY OF ELOY WATER DEPARTMENT REPRESENTATIVE. A SIEVE ANALYSIS OF THE BEDDING AND BACKFILL MATERIAL IS REQUIRED PRIOR TO FINAL ACCEPTANCE.
21. WHERE EXISTING WATER SERVICES ARE TO BE RELOCATED, THE CONTRACTOR SHALL BE RESPONSIBLE FOR RELOCATING THOSE SERVICES TO THE NEW LOCATIONS AS SHOWN ON THE APPROVED PLANS. RELOCATION WORK SHALL INCLUDE, BUT NOT BE LIMITED TO, NEW SERVICE SADDLES AND TAPS, NEW SERVICE PIPE, ANGLE METER STOPS, BALL VALVES, TRACER WIRE, DETECTOR TAPE, SETTING NEW METERS (PROVIDED BY THE CITY OF ELOY WATER DEPARTMENT), AND METER BOXES, AND ALL WORK NECESSARY TO RECONNECT THE PRIVATE PLUMBING.
22. WHERE EXISTING SERVICES ARE TO BE ABANDONED, THE CONTRACTOR SHALL BE RESPONSIBLE FOR REMOVING AND SALVAGING ALL ASSOCIATED MATERIALS RELEVANT TO THE ABANDONED SERVICES, INCLUDING CLOSING AND PLUGGING THE EXISTING CORPORATION STOP, IN ACCORDANCE WITH THE APPROVED PLANS.
23. SALVAGED MATERIALS ARE THE PROPERTY OF THE CITY OF ELOY WATER DEPARTMENT.
  - A. MATERIALS SALVAGED WILL BE DELIVERED TO AN APPROVED CITY OF ELOY SALVAGE AND MAINTENANCE YARD OR TO A PUBLIC LANDFILL AT THE DISCRETION OF THE CITY OF ELOY WATER DEPARTMENT'S AUTHORIZED REPRESENTATIVE. SALVAGE AND DISPOSAL ARE THE RESPONSIBILITY OF THE CONTRACTOR.
  - B. WATER LINE ABANDONMENT IN PLACE WILL BE EXAMINED ON A CASE BY CASE BASIS. VALVE RISERS AND RISER PIPE WILL ALWAYS BE REMOVED FROM PAVED AREAS, AND BACKFILLED AND COMPACTED WITH AGGREGATE BASE COURSE COMPACTED TO THE MINIMUM DENSITY SPECIFIED IN MAG SECTION 601. THE PAVEMENT PATCH SHALL BE SUBJECT TO THE CONDITIONS OF THE RIGHT-OF-WAY PERMIT.

**ISSUED:**


MARCH 2007

**REVISED:**



**SWD-100-2  
GENERAL NOTES**

24. THE CONTRACTOR SHALL MAINTAIN WATER SERVICE AT ALL TIMES AND SHALL MINIMIZE WATER SERVICE INTERRUPTION TO EXISTING WATER SERVICES DURING ALL ACTIVITIES WITHIN THE PROJECT AREA. ALL EXISTING METERS AND LINES FOUND IN CONFLICT WITH THE NEW WATER MAIN ALIGNMENTS WHETHER OR NOT SHOWN ON PLANS SHALL BE SUPPORTED ACROSS THE TRENCH BY THE CONTRACTOR. EXISTING WATER METERS SHALL REMAIN IN PLACE AND ARE NOT TO BE DISTURBED AND / OR RELOCATED BY THE CONTRACTOR DURING WATER MAIN TRENCHING AND INSTALLATION OPERATIONS AND SHALL REMAIN ACCESSIBLE FOR READING OR MAINTENANCE DURING CONSTRUCTION. THE CONTRACTOR SHALL BE HELD LIABLE FOR ANY DAMAGES TO EXISTING WATER METERS AND/OR SERVICE LINES THAT OCCUR DURING HIS TRENCHING AND WATER MAIN INSTALLATION OPERATIONS.
25. MAJOR UTILITY LOCATIONS ARE SHOWN ON THE PLANS. THE CONTRACTOR SHALL COORDINATE THE PROTECTION OF ALL UNDERGROUND AND OVERHEAD UTILITIES IN THE PROJECT AREA, WHETHER SHOWN ON THE APPROVED PLANS OR NOT. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ANY NECESSARY REPAIRS AT HIS OWN EXPENSE.
26. INSPECTORS EMPLOYED BY THE AGENCY SHALL BE AUTHORIZED TO INSPECT ALL WORK DONE AND MATERIALS FURNISHED. SUCH INSPECTION MAY EXTEND TO ALL OR ANY PART OF THE WORK AND TO THE PREPARATION, FABRICATION OR MANUFACTURE OF THE MATERIALS USED. THE INSPECTOR SHALL NOT BE AUTHORIZED TO ALTER OR WAIVE THE PROVISIONS OF THE CONTRACT. THE INSPECTOR SHALL BE AUTHORIZED TO ISSUE INSTRUCTIONS IN KEEPING WITH THE DESIGN INTENT OF THE PLANS AND SPECIFICATIONS. THE INSPECTOR SHALL HAVE THE AUTHORITY TO REJECT DEFECTIVE MATERIALS OR WORK. THE INSPECTOR SHALL BE THE SOLE INTERPRETER OF THE SPECIFICATIONS. ITEMS OF WORK REQUIRING INSPECTION PRIOR TO BEING BACKFILLED OR OTHERWISE CONCEALED BY THE CONTRACTOR, INCLUDE BUT ARE NOT LIMITED TO THE TRENCH DEPTH AND LOCATION, PIPE MATERIALS, AND INSTALLATION, TEMPORARY PLUGS, TAPS AND TIE-INS, SERVICES, DRAIN ASSEMBLY, BEDDING, AND DETECTABLE AND MARKING TAPE INSTALLATION. ANY WORK DONE OR MATERIALS USED WITHOUT INSPECTION BY THE CITY OF ELOY WATER DEPARTMENT MAY BE ORDERED UNCOVERED AND REMOVED OR REPLACED AT THE CONTRACTOR'S EXPENSE EVEN IF THE UNCOVERED WORK IS DETERMINED TO BE UNACCEPTABLE.
27. ONLY APPROVED MATERIALS PER THE APPROVED MATERIALS LIST WILL BE ACCEPTED.
28. ALL FITTINGS, VALVES, FLEXIBLE COUPLINGS, AND REPAIR CLAMPS SHALL BE ENCASED WITH A 10 MIL POLYETHYLENE IN ACCORDANCE WITH AWWA C-105, METHOD C.

ISSUED:			<b>SWD-100-3</b> <b>GENERAL NOTES</b>
MARCH 2007			
REVISED:			

## WATER SERVICE NOTES:

1. Meter boxes shall be set on two 2" x 4" x 12" roman bricks installed under the long axis sides of the box. The meter stop shall be installed at 8" min./10" max. below finished ground surface. Number 3 boxes require 4 bricks.
2. Installation of concrete meter boxes in areas subjected to vehicular traffic shall be avoided. All 5/8" x 3/4" and 1" meter installations in concrete or pavement require a 12" x 20" x 12" Rotocast box with concrete encasements and steel lid (H-20 rated). An H-20 rated lid is to be used in areas subject to vehicular traffic. A pedestrian rated lid is to be used in all other installations.
3. The top of the meter box shall be set 1/2 inch to 1 inch above grade except in concrete sidewalks, driveways, and paved areas where the meter box shall be set flush with the surrounding surface.
4. If obstructions prevent the meter box from being installed at the locations shown on the plans, the water utility will evaluate alternate locations on a case by case basis.
5. All service lines require detectable location tape and a tracer wire. The tape is to be installed 6" above the service line. The tracer wire shall be USE, RHW or RHH solid 10 gauge a continuous length from the corporation and run in to the curb stop. The tracer wire shall be attached with tape or wire ties at 1' intervals to the service line. A minimum 6" coiled wire shall be left at the curb stop.
6. All service lines will be bedded and backfilled using the same materials and methods as the main line.
7. All service taps will be at a 45' angle and must face the property where the meter will be installed. Multiple taps on PVC shall be in accordance with Note 11.
8. When using HDPE a support post must be installed in accordance with Standard Details 3/4" METER INSTALLATION AND 1" SPLIT SERVICE CONNECTION.
9. All meter box installations will initially have the pipe access holes (mouse holes) blocked with suitable material to prevent backfill of dirt into box.
10. A meter locating ring shall be supplied by the water utility. The contractor shall install the locating ring within 3 inches (75mm) of the top of the angle meter stop.
11. Taps made into PVC pipe shall be at least 2 feet from the spigot end and 1 foot from the bottom of the bell; multiple taps shall be at least 30" apart; multiple taps within an individual section of PVC pipe shall not be located on the same axis. The minimum offset shall be 5 degrees.
12. Taps into ductile iron pipe shall be at 45 degrees to horizontal as shown. Multiple taps can be made as close to each other as practible. Taps shall be a minimum of 2' from the spigot and a minimum of 1" from the bell.

ISSUED:

MARCH 2007

REVISED:



**SWD-110**  
**WATER SERVICE NOTES**

## LEGEND

D OUTSIDE DIAMETER OF PIPE

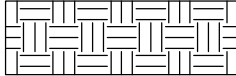


D+18 INCHES MINIMUM AND D+24" MAXIMUM



4 INCHES FOR PIPE DIAMETERS 12 INCHES AND SMALLER:  
6 INCHES FOR PIPE DIAMETERS LARGER THAN 12 INCHES  
EXCEPT WHEN ON UNYIELDING OR UNSTABLE MATERIAL, THEN AS PER  
MAG STANDARD SPECIFICATION SECTION 601.4.

DIMENSIONS NOTED ARE AFTER INSTALLATION OF PIPE.



NATIVE UNDISTURBED SOIL



TRENCH BACKFILL MATERIAL (MAG STD. SPEC. SECTION 601.4)



BEDDING MATERIAL (MAG STD. SPEC. SECTION 601.4)

## NOTES:

1. Construction staking shall be performed in accordance with the accepted standard of care. Sealed staking sheets are required prior to final acceptance.
2. Pipe shall be in a trench condition in natural ground. In no case shall pipe be installed with less than 36" of cover during construction.
3. Bracing and/or shoring shall conform to OSHA requirements.
4. The minimum depths of new water mains and service lines shall be in accordance with the project plans.
5. Refer to MAG Standard Specification Section 601.4 for gradation and compaction requirements for backfill material.
6. Refer to MAG Standard Specification Section 601.4 for gradation and compaction requirements for bedding material.
7. Detectable pipe locating and marking tape shall be 4.0 mil thickness, inert polyethylene plastic impervious to alkalis, acids, chemical reagents and solvents likely to be encountered in the soil, with a minimum 1/3-mil metallic foil. The tape shall be at least six inches (6") in width and shall be solid blue with the following printed: "CAUTION – BURIED WATERLINE BELOW" Detection wire shall be #12 AWG THHN solid copper. Continuity shall be verified in the presence of a City of Eloy Inspector, or assignee.
8. Pavement patching shall conform to the requirements of MAG Standard Detail 200.

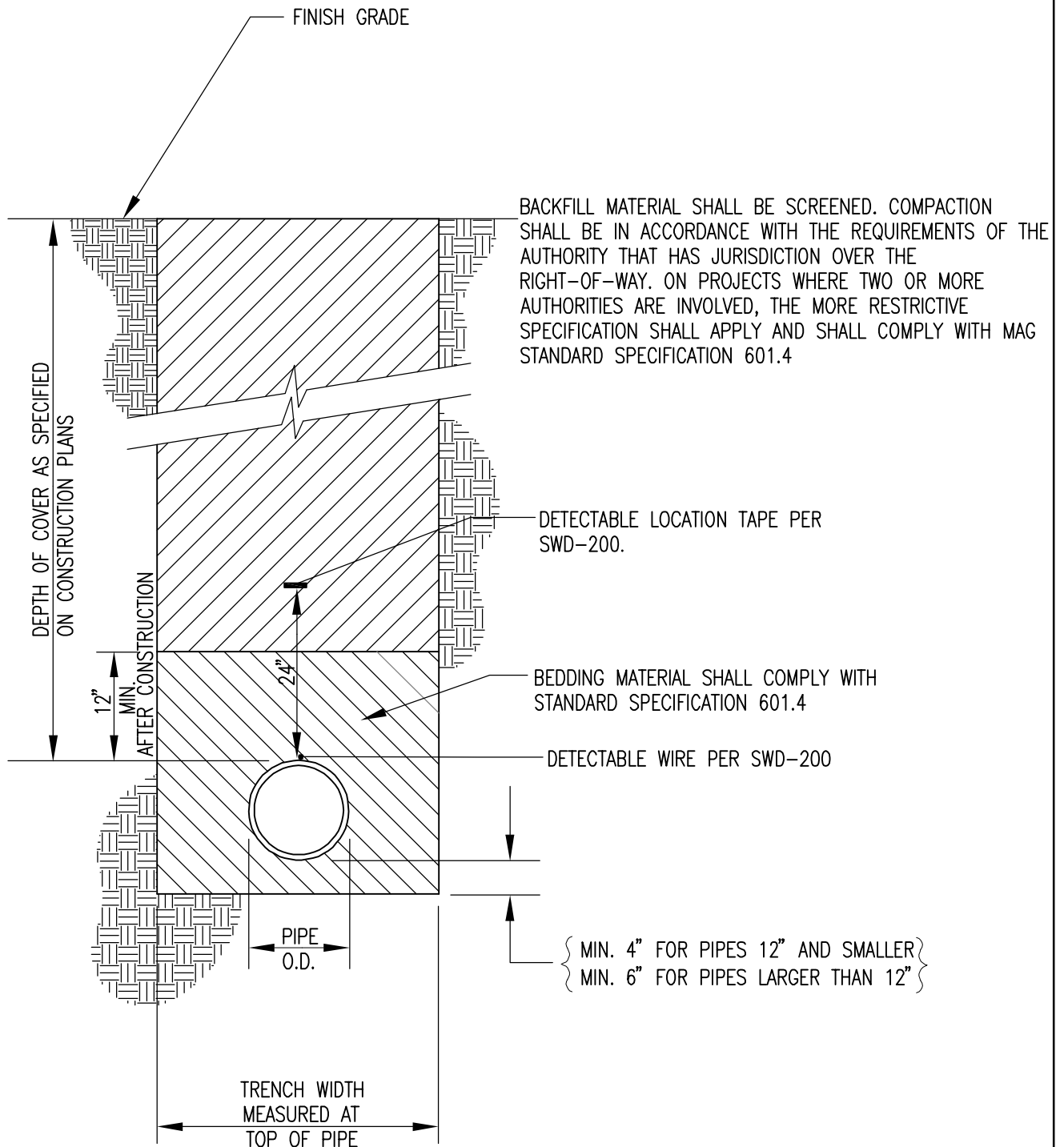
ISSUED:

MARCH 2007

REVISED:



**SWD-200-1  
TRENCH DETAIL**



1. TRENCH WIDTH MEASURED AT TOP OF THE PIPE SHALL BE 18" FOR 4" AND 6" MAINS, AND 24" FOR 8" MAINS  
TRENCH WIDTH FOR 12" AND LARGER MAINS SHALL BE O.D. + 18" MIN AND O.D. + 24" MAX.

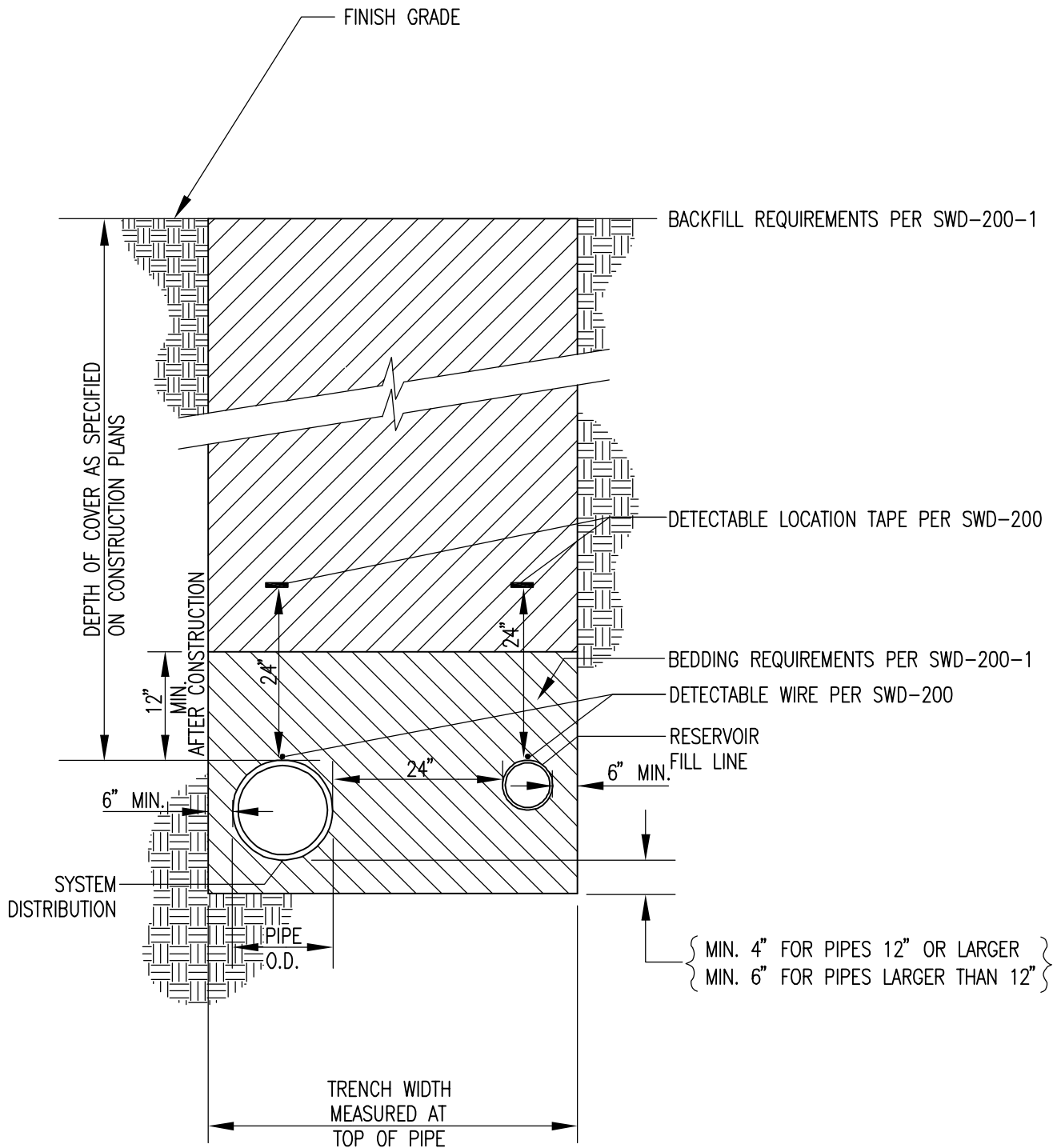
ISSUED:

MARCH 2007

REVISED:



**SWD-200-2**  
**TRENCH DETAIL**



TRENCH WIDTH MEASURED AT TOP OF THE PIPE SHALL BE SYSTEM DISTRIBUTION PIPE O.D. + FILL LINE O.D. + 18" MIN, SYSTEM DISTRIBUTION PIPE O.D. + FILL LINE O.D. + 24" MAX.

ISSUED:

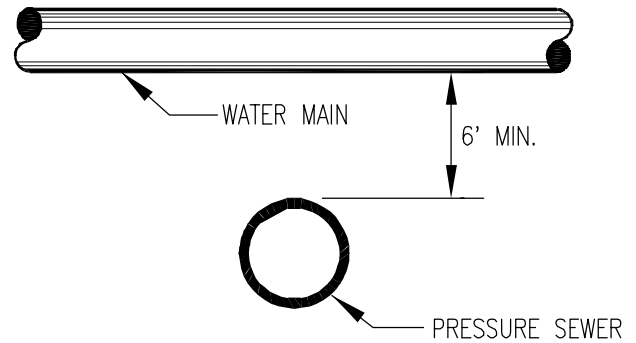
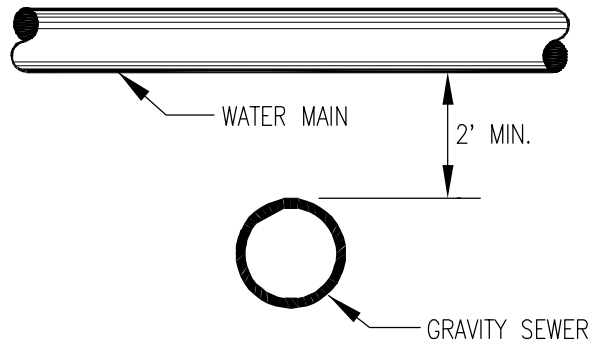
MARCH 2007

REVISED:



**SWD-200-3**  
**TRENCH DETAIL**

## VERTICAL SEPARATION

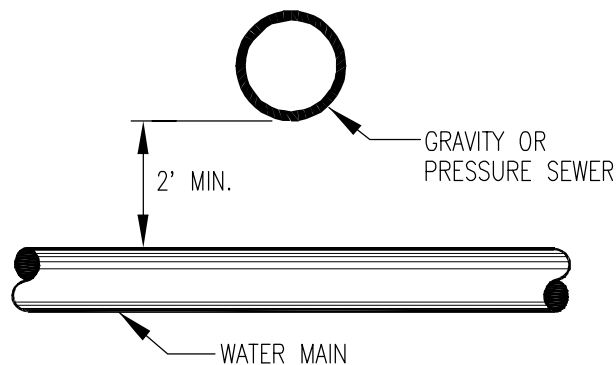


### GRAVITY SEWER CROSSING

(SEWER UNDER WATER MAIN)

### PRESSURE SEWER CROSSING

(SEWER UNDER WATER MAIN)



### GRAVITY OR PRESSURE SEWER CROSSING

(SEWER ABOVE WATER MAIN)

#### NOTES:

1. Where a water main crosses above a gravity sewer with 2' or greater vertical clearance (outside surface to outside surface), no extra protection is required. Where a water main crosses above a pressure sewer with 6' or greater clearance, no extra protection is required.
2. Where water main must cross above a gravity sewer with less than 2' of clearance or above a pressure sewer with less than 6' of clearance, construct or replace the sewer line with ductile iron pipe (D.I.P.) or equal. The D.I.P. shall have a "push-on" joint or approved equal if the sewer joints are located 6' or more beyond the outside surface of the water main. If the joint is located less than 6' from the outside surface of the water main, then a restrained joint or approved equal shall be used. Refer to sheet 3 of 3. In no case shall the water main be less than 1' above a gravity sewer or 2' above a pressure sewer.
3. Where a water main crosses below either a gravity sewer or a pressure sewer, construct or replace the sewer line with D.I.P. or approved equal following the guidelines given in note No. 2. In no case shall the water main be less than 2 feet below either a gravity or pressure sewer line.

**ISSUED:**

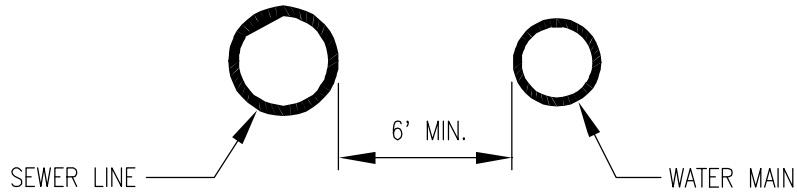
MARCH 2007

**REVISED:**

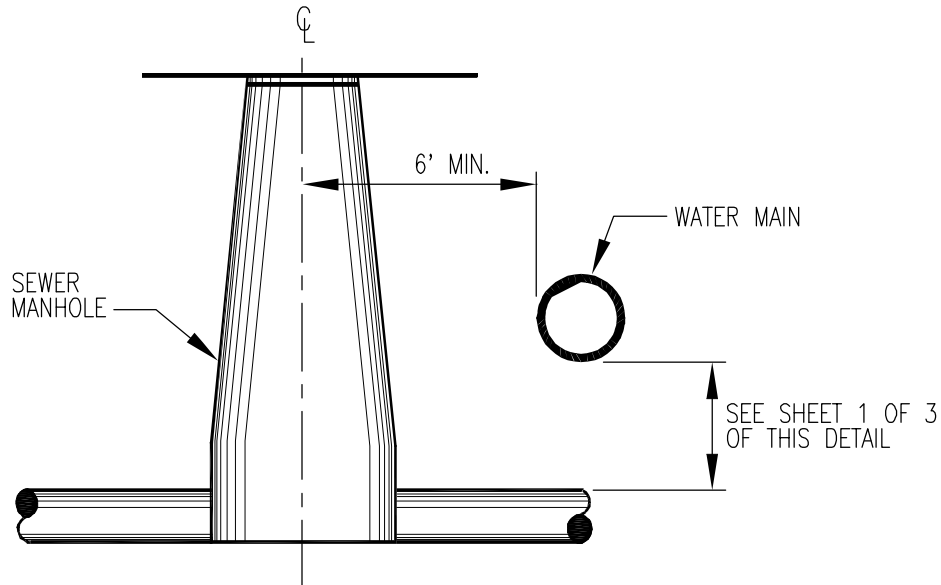


**SWD-300-1  
SEWER / WATER  
CROSSING DETAIL**

## HORIZONTAL SEPARATION



### SEWER / WATER SEPARATION (PARALLEL ALIGNMENTS)



#### NOTES (CONTINUED):

4. The minimum horizontal clearance without extra protection between a water main and a pressure or gravity sewer line shall be 6' outside surface to outside surface.
5. The minimum horizontal clearance between a water main and a sewer manhole shall be 6' from the outside surface of the water main to the centerline of the manhole.
6. Where a 6' horizontal clearance cannot be maintained with a gravity sewer, construct or replace the sewer line with D.I.P. or approved equal following the guidelines given in note No. 2. In no case shall a gravity sewer line be located less than 2' horizontally from a water main.
7. In no case shall a pressure sewer line be located less than 6' horizontally from a water main.
8. The American National Standard for the thickness design of ductile iron pipe (ANSI/AWWA C150/A21.50) shall be used to determine the required class of D.I.P. except that for D.I.P. with a diameter of 3" thru 24", a minimum of Class 350 is required and for D.I.P. with a diameter greater than 24", a minimum of Class 200 is required.

**ISSUED:**

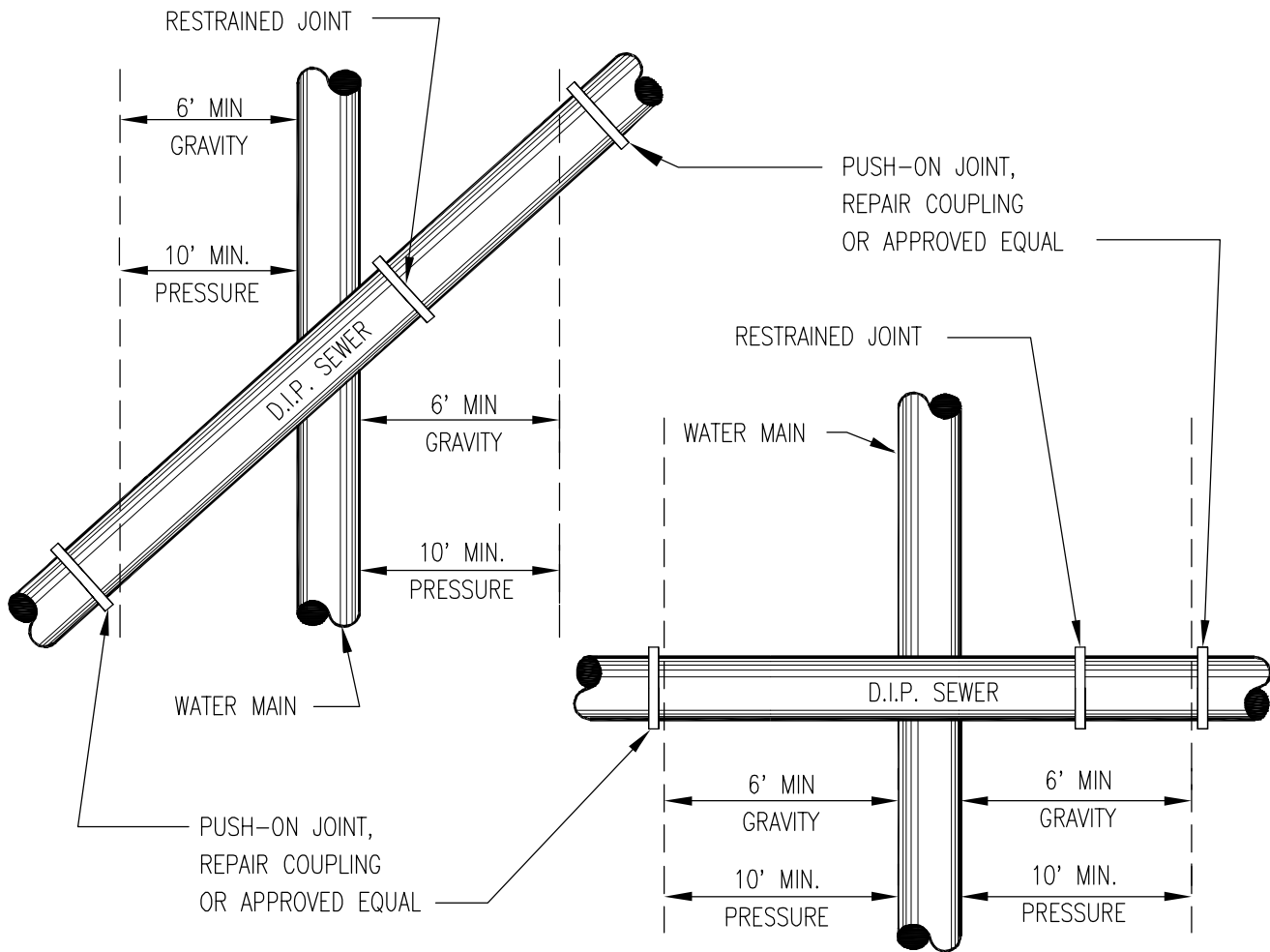
MARCH 2007

**REVISED:**



**SWD-300-2  
SEWER / WATER  
CROSSING DETAIL**

## PLAN VIEWS



### NOTES (CONTINUED):

9. Where the sewer line is a gravity sewer, the D.I.P. installation or replacement shall extend a minimum of 6' beyond each side of the water main, measured horizontally from and perpendicular to the water main.
10. Where the sewer line is a pressure sewer, the D.I.P. installation or replacement shall extend a minimum of 10' beyond each side of the water main, measured horizontally from and perpendicular to the water main.
11. When unusual conditions such as, but not limited to, highway or bridge crossings prevent the water and sewer line separations required by this detail from being met, the City of Eloy Water/Wastewater Management Department will review and may approve (subject to Arizona Department of Environmental Quality approval), request for authorization to use alternate construction techniques, material and joints on a case by case basis.
12. All ductile iron pipe shall be internally lined to meet the most recent City of Eloy Water/Wastewater Department specifications.

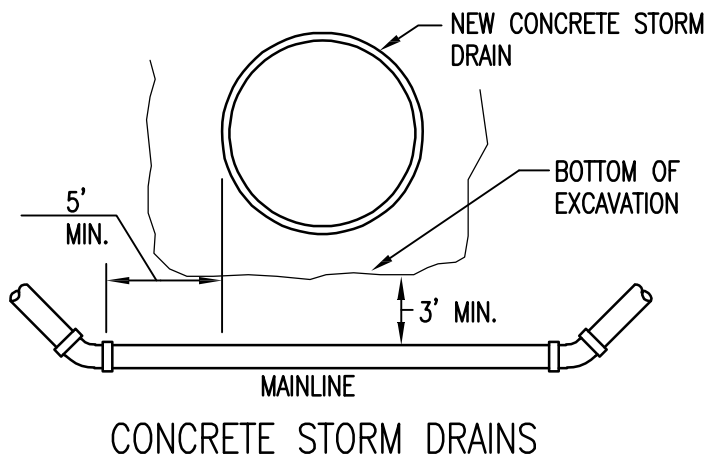
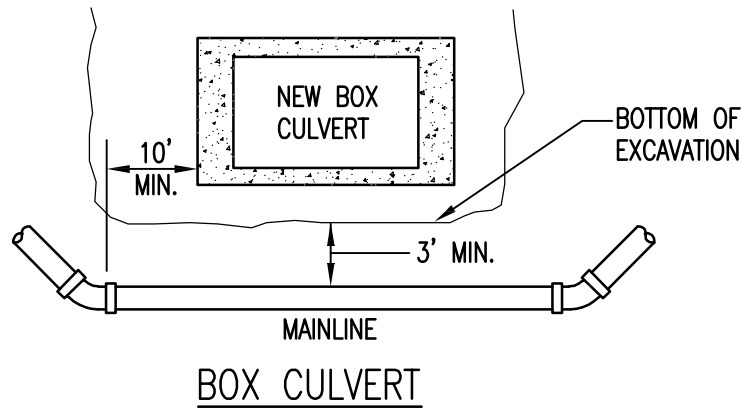
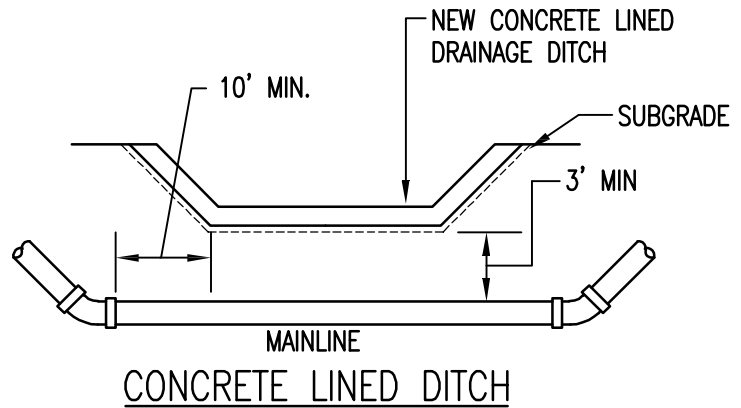
ISSUED:

MARCH 2007

REVISED:



**SWD-300-3  
SEWER/WATER  
CROSSING DETAIL**



NOTES:

1. Mainline water pipe beneath new drainage facilities shall be ductile iron pipe. elevation differentials shall be accomplished by using vertical bends. ductile iron pipe shall extend from top vertical bend to top vertical bend. use of pvc pipe shall be evaluated on a case by case basis.
2. Thrust restrain considerations for vertical bends shall be in accordance with SWD 800.
3. Water Main below new multiple concrete storm drains or CMP's or unstable channels/ditches shall be evaluated on a case by case basis.
4. All joint under facilities shall be restrained.

ISSUED:

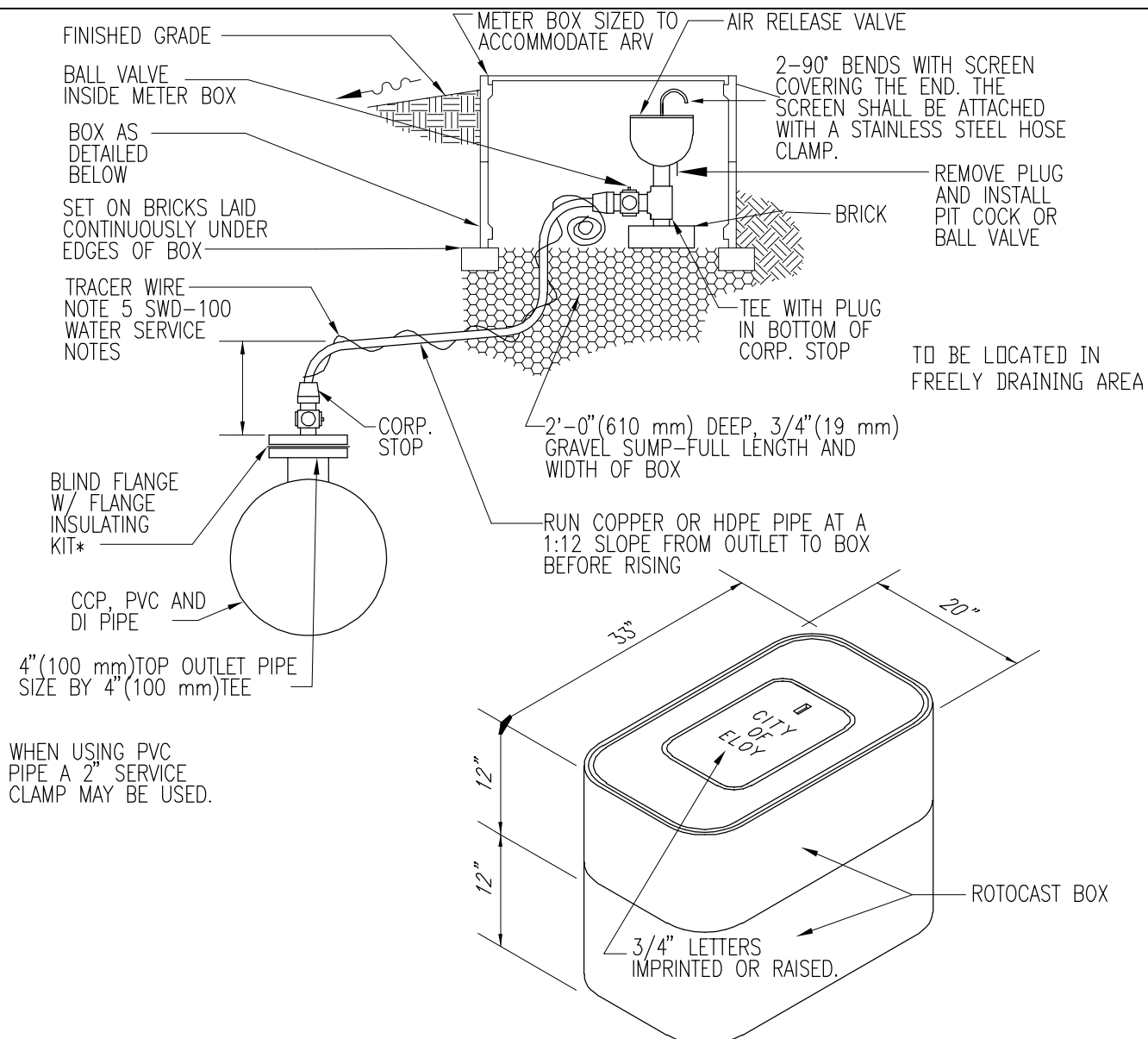
MARCH 2007

REVISED:



**SWD-400**  
**WATER/STORM DRAIN**  
**SEPARATION**

# **SWD-500-1 AIR RELEASE VALVE INSTALLATION 3/4" & 1"**



WHEN USING PVC PIPE A 2" SERVICE CLAMP MAY BE USED.

## 2" ARV & BOX DETAIL

FOR CCP, HDPE, DI AND PVC PIPE  
NOT TO SCALE

### NOTES

All Air Release valves shall be combination air/vacuum type valves.

- \* When using HDPE, a steel support post must be used. The support post shall be a No. 5 rebar, a minimum of 4' in length to support the ball valve. Secure to post with nylon zip ties.

Flange insulating kit must be tested to confirm isolation prior to backfill. Include test results in final corrosion report.

- \*\* Flange insulating kit not required when using HDPE pipe for a pipe run.

All air release valve installations require a tracer wire. The tracer wire shall use RHW, or RHH solid 10 gauge and run in a continuous length from the corporation stop to ball valve. The tracer wire shall be attached to the air release line with tape or wire ties at 1' intervals. A 6" coil of wire shall be left in the meter box.

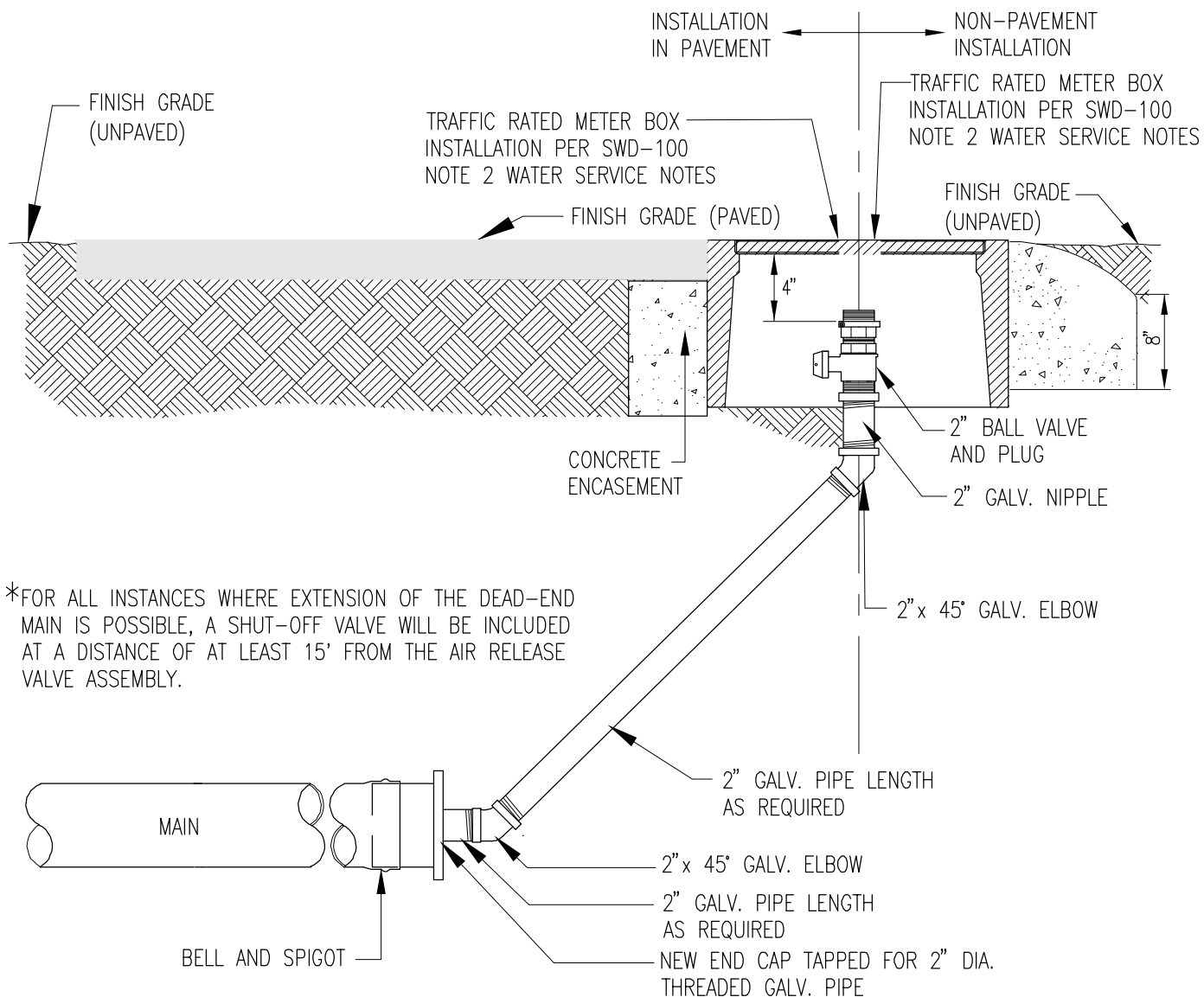
ISSUED:

MARCH 2007

REVISED:



**SWD-500-2**  
**2" AIR RELEASE VALVE**  
**INSTALLATION**



NOTES:

1. The pipe and assembly shall be mechanically restrained in accordance with SWD-800.
2. Concrete thrust blocks may be used if approved by the engineer.
3. Place meter box to center ball valve in middle of box.

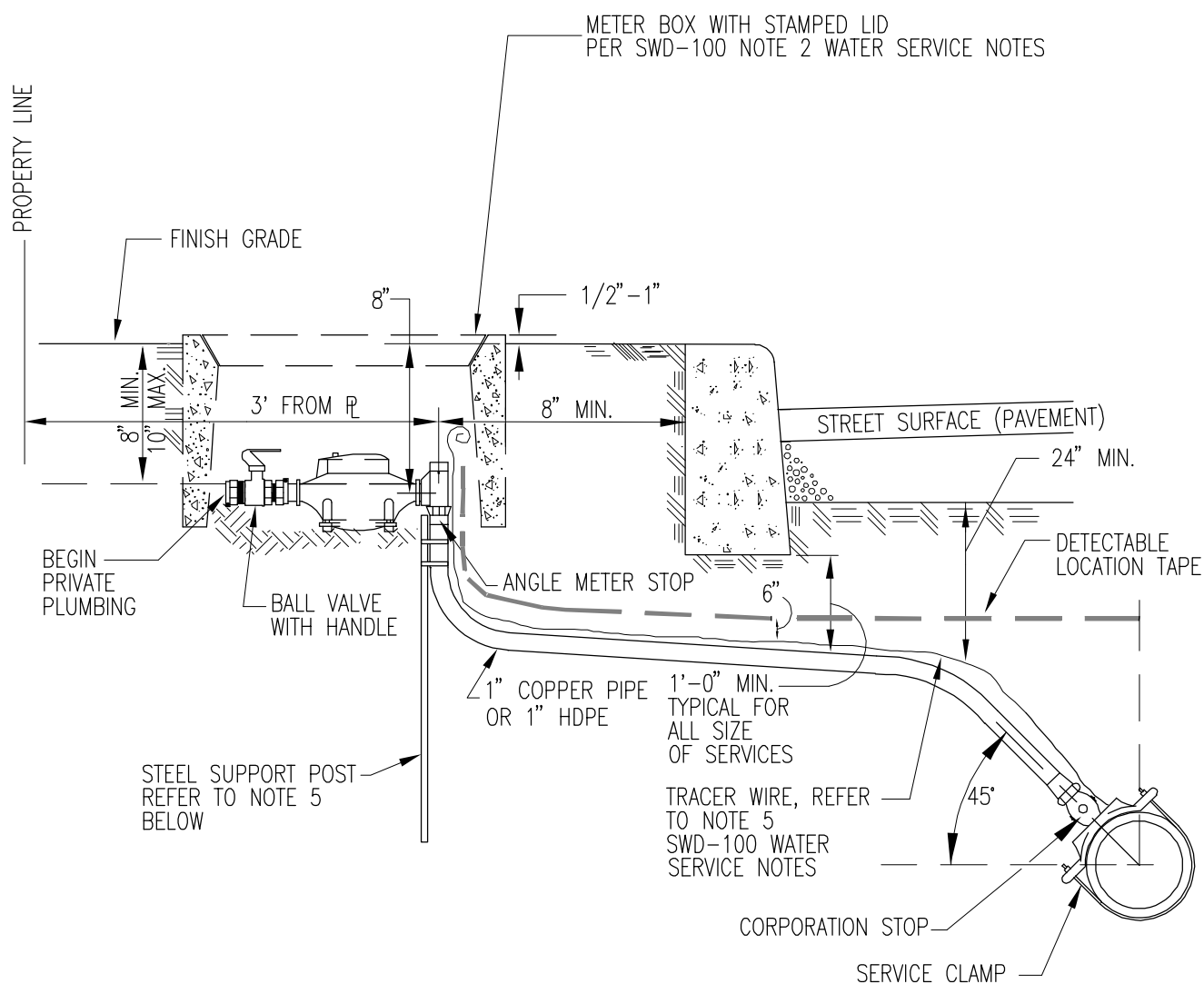
ISSUED:

MARCH 2007

REVISED:



**SWD-600  
DRAIN VALVE ASSEMBLY  
INSTALLATION**



**NOTES:**

1. Meter box shall be supported by two 2"x4"x12" roman bricks installed under the long axis sides of the box.
2. Private plumbing must be adjusted to match meter elevation.
3. If meter box is located in a sidewalk area, the box shall be installed adjacent to back of curb.
4. For D.I.P. refer to Note 12 of SWD-100 Water Service Notes.
5. When using HDPE, a steel post must be used for support. The steel support post shall be a No. 5 rebar. Secure service line to post with nylon zip ties. The post shall be a minimum of 4' in length to support the curb stop.
6. Meter box installation in new sidewalk shall be evaluated on a case by case basis.

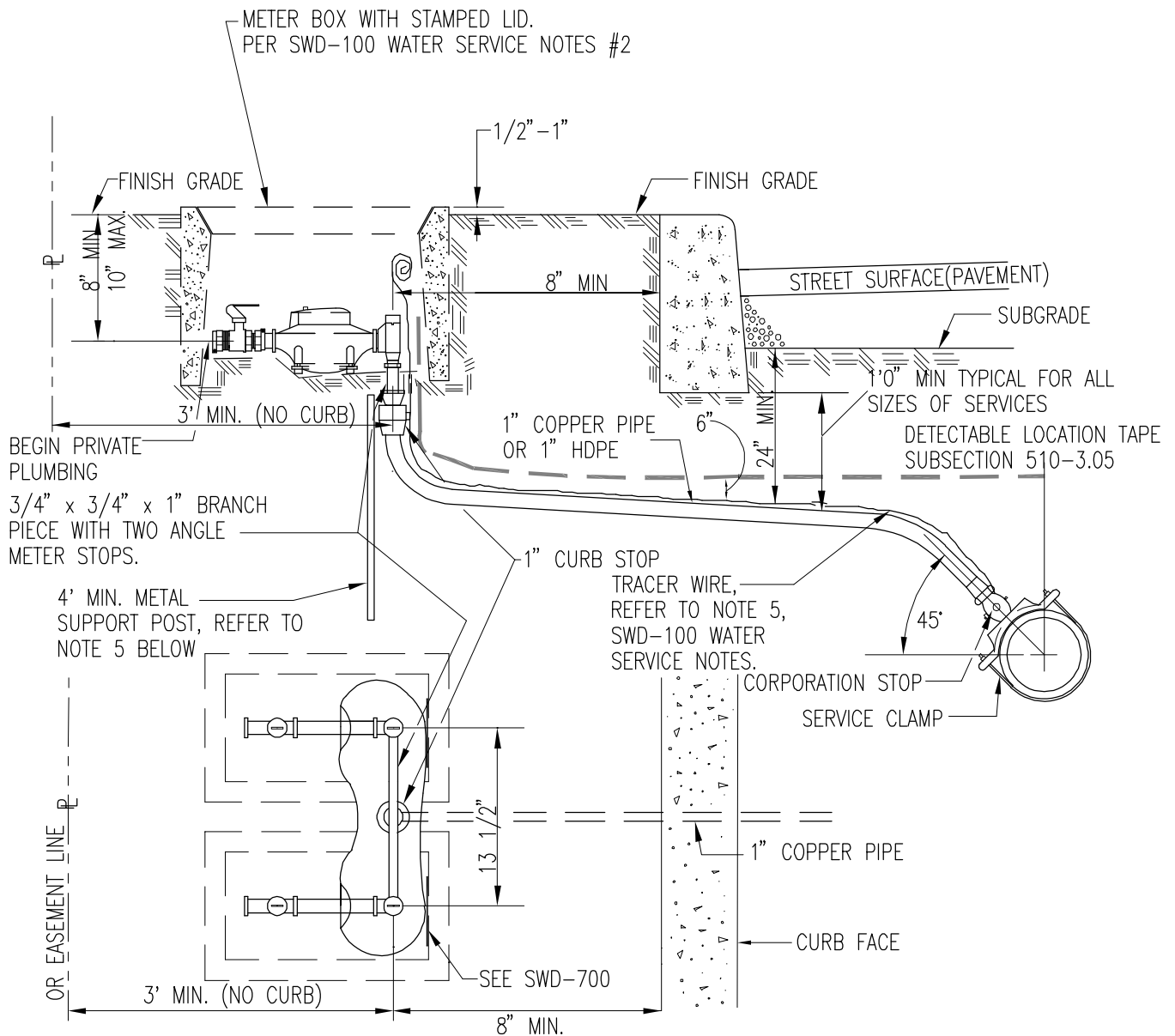
**ISSUED:**

MARCH 2007

**REVISED:**



**SWD-700-1  
3/4" & 1" METER  
INSTALLATION**



#### NOTES

1. Meter box shall be supported by two 2" x 4" x 12" solid roman bricks installed under the long axis sides of the box.
2. Private plumbing must be adjusted to match new meter elevation.
3. If meter box is located in sidewalk area, the box shall be installed adjacent to back of curb.
4. For D.I.P., refer to Note 12, SWD-100 Water Service Notes.
5. When using HDPE, a steel support post must be used for support. The steel support post shall be a No. 5 rebar. Secure serviceline to post with nylon zip ties.
6. Meter box installation in the new sidewalk areas shall be evaluated on a case by case basis.

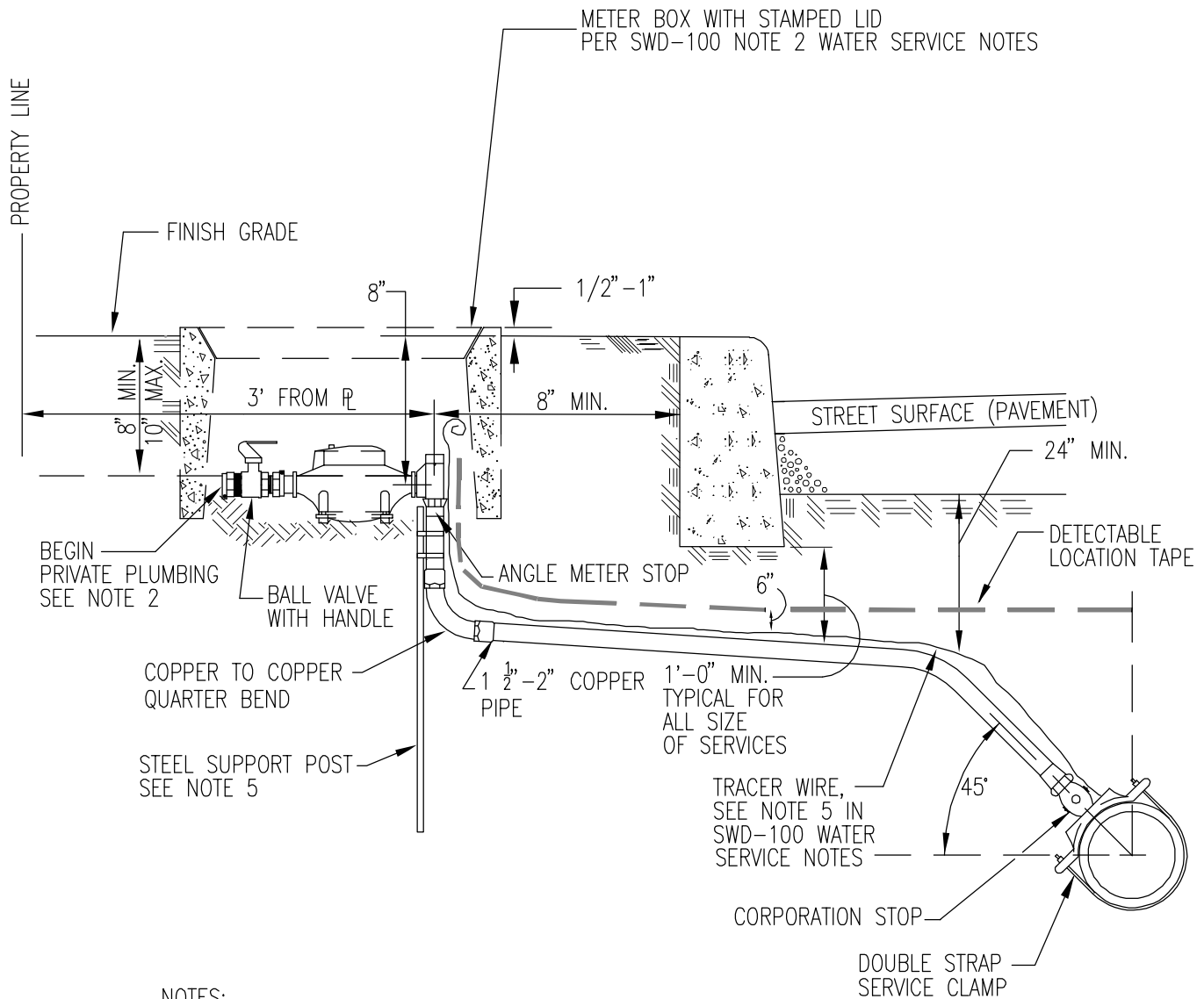
ISSUED:

MARCH 2007

REVISED:



**SWD-700-2**  
**SPLIT WATER SERVICE**  
**DUAL 3/4" METER**  
**INSTALLATION**



**NOTES:**

1. Meter box shall be supported by two 2"x4"x12" roman bricks installed under the long axis sides of the box.
2. Private plumbing must be adjusted to match meter elevation.
3. If meter box is located in a sidewalk area, the box shall be installed adjacent to back of curb.
4. For D.I.P. refer to Note 12 of SWD-100 Water Service Notes.
5. A steel post must be used for support. The steel support post shall be a No. 5 rebar. Secure service line to post with nylon zip ties. The post shall be a minimum of 4' in length to support the curb stop.
6. Meter box installation in new sidewalk shall be evaluated on a case by case basis.

**ISSUED:**

MARCH 2007

**REVISED:**



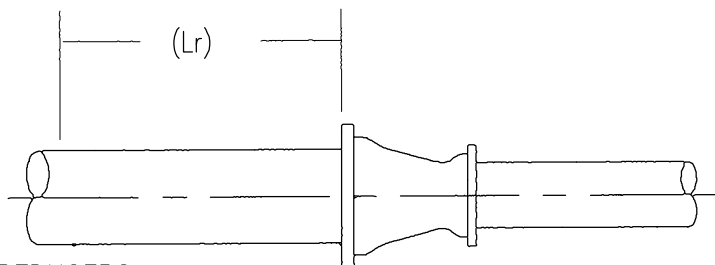
**SWD-760**  
**1 1/2" AND 2" METER**  
**INSTALLATION**

## NOTES

- The lengths of restrained or continuous pipe called out in the following tables are for installation of mechanically restrained fittings and are calculated based on the following parameters.
  - All ductile iron (DI) is polyethylene encased.
  - The soil type is "GP" as defined by the Unified Soil Classifications, ASTM Standard D 2487.
  - The test pressure of the water system is 200 psi.
  - The trench is Type 5, as per ANSI/AWWA C150/A 21.5, Trench Conditions.
  - The depth of cover is 2'.
  - The safety Factor used is 1.5.
- If field conditions varying significantly from these parameters are encountered, the contractor shall immediately advise the Engineer. The Engineer will advise the contractor of the required length of restrained pipe necessary to meet the existing conditions based on the restraint tables.
- The following restraint tables will be used unless alternate tables are approved by the Engineer or shown on the approved plans.

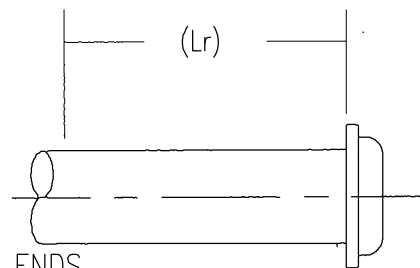
REDUCER SIZE & PIPE MATERIAL		MINIMUM RESTRAINED LENGTH
PVC PIPE	6"X4"	53'
	8"X4"	97'
	8"X6"	56'
	12"X4"	164'
	12"X6"	137'
	12"X8"	100'
D.I. POLY WRAP	6"X4"	81'
	8"X4"	147'
	8"X6"	85'
	12"X4"	247'
	12"X6"	207'
	12"X8"	151'

REDUCER SIZE & PIPE MATERIAL		MINIMUM RESTRAINED LENGTH
PVC PIPE	4"	74'
	6"	104'
	8"	135'
	12"	189'
D.I. POLY WRAP	4"	112'
	6"	157'
	8"	204'
	12"	284'



### REDUCERS

The minimum length of pipe (Lr) to be restrained on the larger side of the reducer shall be derived from the table to the left.



### DEAD ENDS

The minimum length of pipe (Lr) to be restrained on a dead end shall be derived from the table to the left. Or concrete blocks may be used with permission of the Engineer.

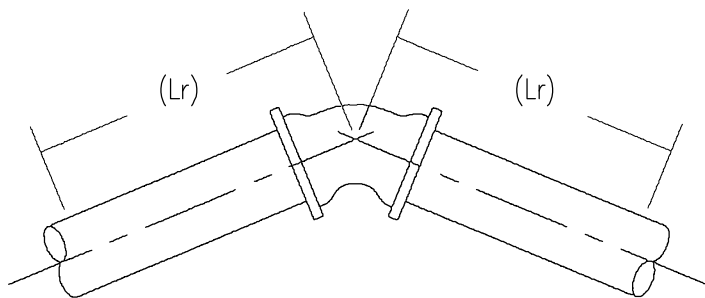
**ISSUED:**

MARCH 2007

**REVISED:**

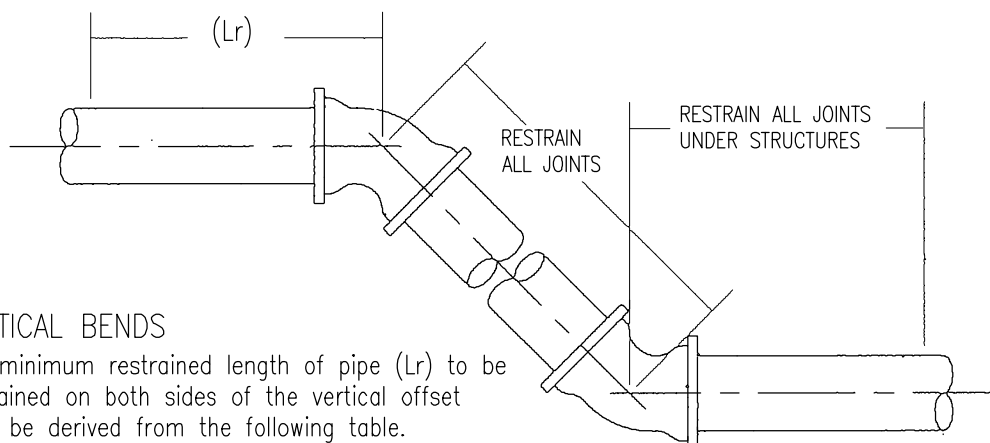


**SWD-800-1  
JOINT RESTRAINT**



### HORIZONTAL BENDS

The minimum restrained length of pipe (Lr) to extend in both directions from the horizontal bend shall be derived from the following table.



### VERTICAL BENDS

The minimum restrained length of pipe (Lr) to be restrained on both sides of the vertical offset shall be derived from the following table.

PIPE SIZE & MATERIAL		HORIZONTAL BENDS				VERTICAL BENDS			
		11 1/4°	22 1/2°	45°	90°	11 1/4°	22 1/2°	45°	90°
PVC PIPE	4"	3'	5'	11'	27'	7'	15'	31'	*
	6"	4'	7'	15'	37'	10'	21'	43'	*
	8"	5'	10'	20'	48'	13'	27'	56'	*
	12"	6'	13'	27'	65'	19'	38'	78'	*
D.I. POLY WRAP	4"	3'	6'	13'	31'	11'	22'	46'	*
	6'	4'	8'	18'	42'	15'	31'	65'	*
	8'	5'	11'	23'	54'	20'	41'	84'	*
	12'	7'	15'	31'	74'	28'	57'	118'	*

\* NOT RECOMMENDED

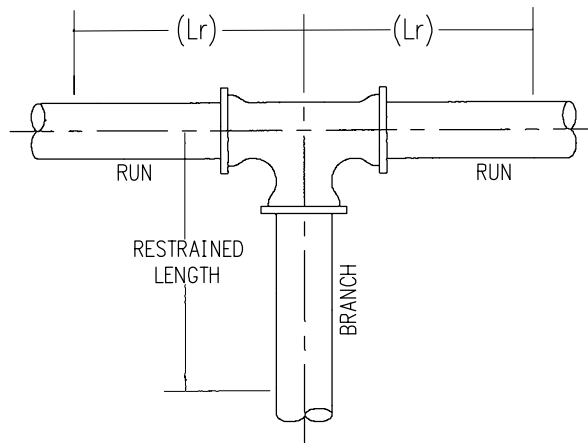
ISSUED:

MARCH 2007

REVISED:



**SWD-800-2  
JOINT RESTRAINT**



## TEES

The minimum attached length of pipe (Lr) to extend in each direction along the run of the Tee shall be a solid pipe without joints, fittings, etc. The length of the restrained branch shall be derived from the following table.

TEE SIZE & PIPE MATERIAL		MINIMUM ATTACHED LENGTH OF PIPE										
		0'	2'	4'	6'	8'	10'	12'	14'	16'	18'	20'
		LENGTH OF RESTRAINED BRANCH										
PVC PIPE	4"x4"	74'	64'	53'	42'	32'	21'	11'	1'	1'	1'	1'
	6"x4"	74'	58'	42'	26'	11'	1'	1'	1'	1'	1'	1'
	6"x6"	104'	93'	82'	71'	61'	50'	39'	28'	18'	7'	1'
	8"x4"	74'	53'	31'	10'	1'	1'	1'	1'	1'	1'	1'
	8"x6"	104'	89'	75'	60'	46'	31'	17'	3'	1'	1'	1'
	8"x8"	135'	124'	113'	102'	91'	80'	69'	59'	48'	37'	26'
	12"x4"	74'	41'	7'	1'	1'	1'	1'	1'	1'	1'	1'
	12"x6"	104'	81'	58'	35'	13'	1'	1'	1'	1'	1'	1'
	12"x8"	135'	118'	101'	83'	66'	49'	32'	15'	1'	1'	1'
	12"x12"	189'	177'	166'	155'	144'	132'	121'	110'	98'	87'	76'
D.I. POLY WRAP	4"x4"	112'	96'	80'	64'	48'	32'	17'	1'	1'	1'	1'
	6"x4"	112'	88'	64'	40'	16'	1'	1'	1'	1'	1'	1'
	6"x6"	157'	141'	124'	108'	92'	75'	59'	43'	27'	10'	1'
	8"x4"	112'	80'	48'	15'	1'	1'	1'	1'	1'	1'	1'
	8"x6"	157'	135'	113'	91'	70'	48'	26'	4'	1'	1'	1'
	8"x8"	204'	187'	171'	145'	138'	121'	105'	88'	72'	55'	39'
	12"x4"	112'	61'	11'	1'	1'	1'	1'	1'	1'	1'	1'
	12"x6"	157'	122'	88'	54'	19'	1'	1'	1'	1'	1'	1'
	12"x8"	204'	178'	152'	126'	100'	74'	48'	22'	1'	1'	1'
	12"x12"	284'	267'	250'	233'	216'	199'	182'	165'	148'	131'	114'

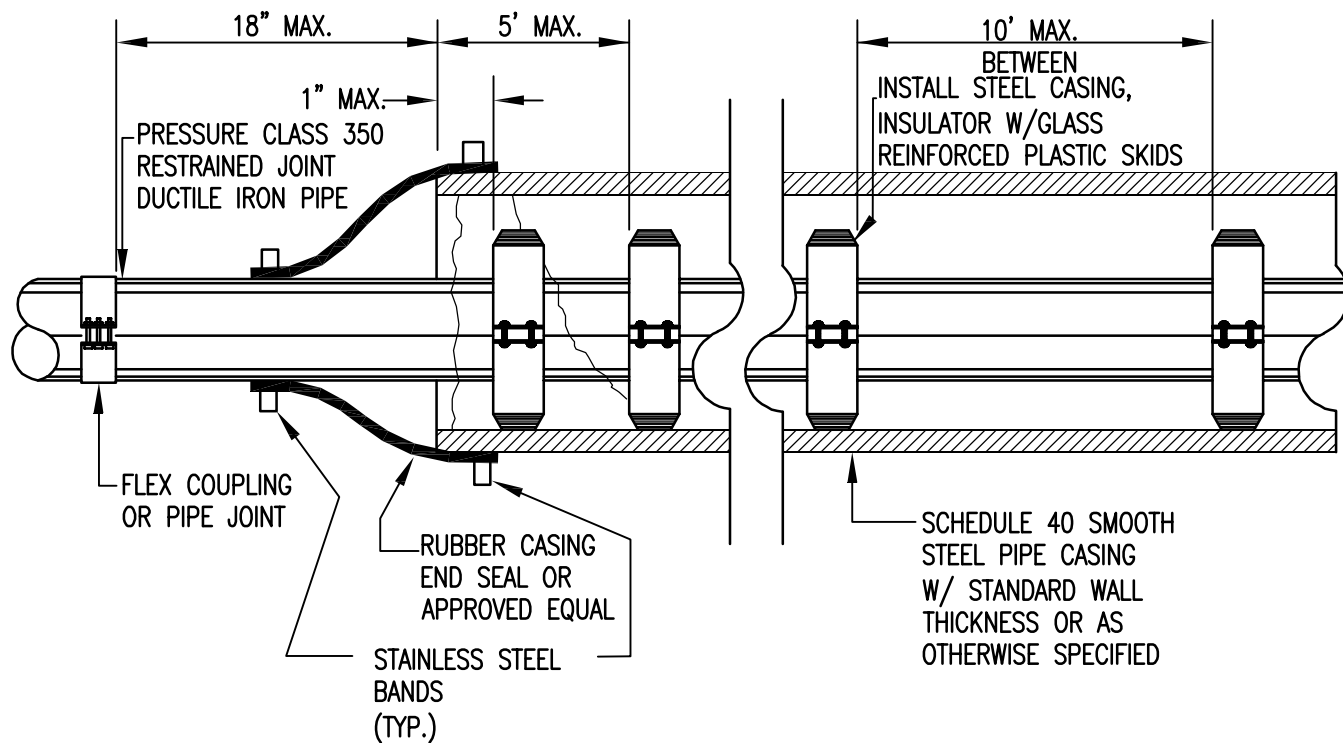
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MARCH 2007

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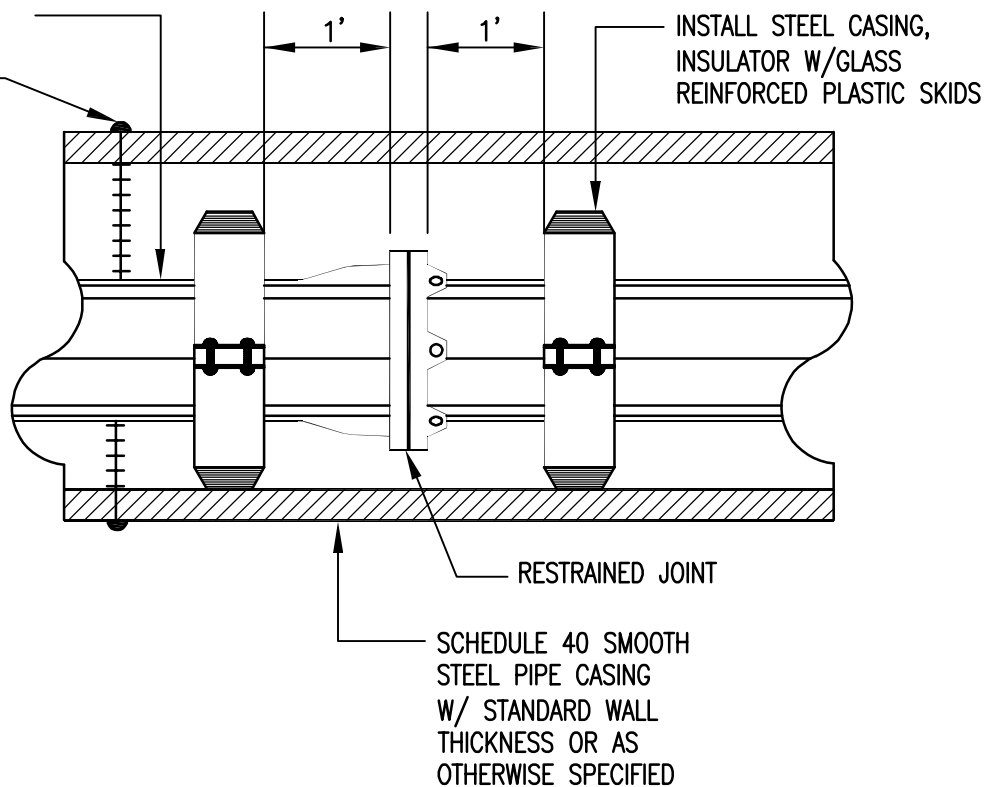


**SWD-800-3  
JOINT RESTRAINT**



PRESSURE CLASS 350  
RESTRAINED JOINT  
DUCTILE IRON PIPE

BUTT WELD PER  
ASME, SECTION 9



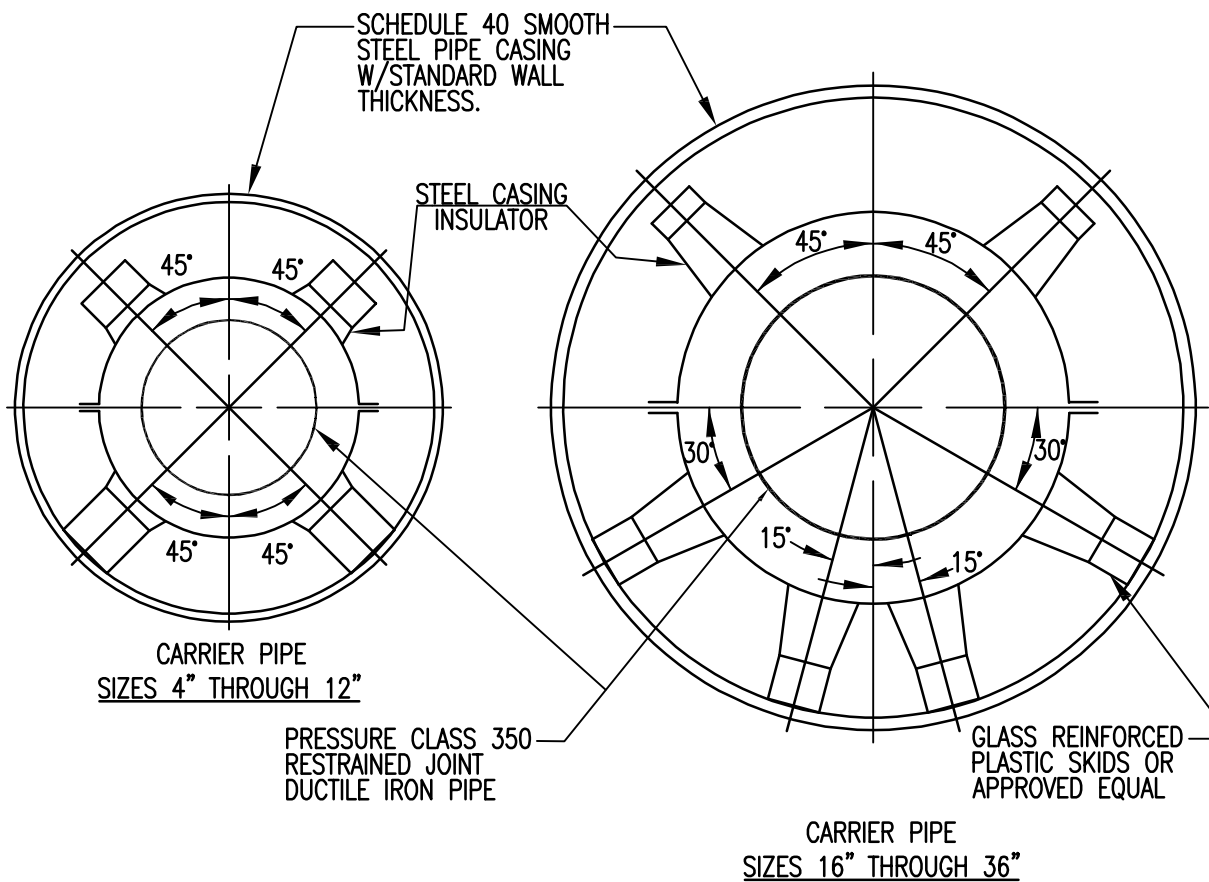
ISSUED:

MARCH 2007

REVISED:



**SWD-900-1**  
**BORING AND CASING**



PIPE SIZE	MATERIAL	
	PRESSURE CLASS 350 RESTRAINED JOINT DUCTILE IRON	
	MAX. O.D. RESTRAINED JT.	MIN. CASING O.D.
4"	10.20"	16"
6"	12.30"	18"
8"	14.45"	22"
12"	18.30"	28"
16"	22.90"	32"
24"	32.94"	40"
30"	39.17"	48"

ISSUED:

MARCH 2007

REVISED:



**SWD-900-2  
BORING AND CASING**

## GENERAL

The contractor shall be responsible for obtaining all permits, traffic control, shoring and bracing of jacking and receiving pits, bedding, backfill, over excavation, compaction, or any other work not specifically mentioned herein, considered by the Agency to be associated with the installation of the carrier pipe inside the steel casing. The Contractor shall comply with all requirements specified herein, on the project plans or in the Special Provisions.

## CASING

Casing size shall be as specified in the table included in this detail. All casing shall be schedule 40 "standard wall" smooth steel pipe unless otherwise noted. Casing alignment, both horizontal and vertical, shall not deviate more than 0.20 feet from the grade specified on the approved plans.

Casing shall be butt welded around the entire circumference of each joint to provide a water tight seam. Welding shall be accomplished by Certified Welders in accordance with A.S.M.E. Section 9.

## CARRIER PIPE

Carrier pipe size shall be as specified on the approval plans. Pipe material shall be Pressure Class 350, Restrained Joint Ductile Iron Pipe. The restraint feature shall be Mechanical Joints with EBAA Iron Series 1100 "Mega-Lug" restraint glands or U.S. Pipe "TR Flex" restrained joint pipe. Other manufacturers may be permitted with prior approval of the Agency.

## CASING INSULATORS

Casing insulators shall be steel. Band width shall be as per manufacturers recommendations depending on pipe size. Steel shall be painted or fusion coated with plastic. Insulators shall be provided with PVC liners installed between the band and carrier pipe O.D.

Skids shall be glass reinforced plastic or other abrasion resistant insulating material. Under no circumstances shall metal skids be permitted. Skid height shall be adequate to prevent carrier pipe from contacting steel casing. Minimum installed clearance between the carrier pipe or mechanical connections and steel casing shall be two inches.

## CASING END SEALS

Casing end seals shall be "PSI, Inc. model C" pull on casing end seals or approved equal. Alternate methods for sealing casing ends shall be subject to approval by the Engineer.

## TESTING

After the steel casing and carrier pipe have been installed, but at least 48 hours prior to backfilling the jacking pit, the contractor shall contact the water utility to schedule an inspection by their NACE technician.

The water utility's NACE Technician shall conduct tests to verify that the carrier pipe is not in contact and shorted to the casing. Should the technician find an electrical short, the contractor shall correct the deficiency and schedule a re-test. When the technician has verified that no shorts exist between the steel casing and carrier pipe, the contractor may proceed with backfilling the jacking pit.

Testing and verification by the NACE technician does not relieve contractor from performing all tests and obtaining satisfactory results.

ISSUED:

MARCH 2007

REVISED:



**SWD-900-3  
BORING AND CASING**

## PRODUCT

Polyvinyl Chloride (PVC) Pressure Pipe 4-inch through 12-inch for Water Distribution shall be per ANSI/AWWA C900.

Polyvinyl Chloride (PVC) Water Transmission Pipe 14-inch through 36-inch for Water Transmission shall be per ANSI/AWWA C905.

Water main distribution pipe shall be made in accordance with AWWA C900 from a compound conforming to a cell classification of 12454 as defined by ASTM D1784. Integral bells shall incorporate gaskets meeting the requirements of ASTM F477 and be locked in to the bell. The assembled joint shall meet the requirements of ASTM D3139. The laying length of the pipe shall be 20 ft. The pipe and gasket must be tested and approved for contact with potable water in accordance with ANSI/NSF 61. The pipe and gasket shall be listed by Underwriters Laboratory and approved by Factory Mutual.

## PRESSURE CLASS

Unless otherwise specified on the plans or in the specifications, 4-inch through 12-inch PVC pipe shall be pressure class 150 (cast iron O.D.). PVC pipe 14 -inch through 36-inch shall be pressure class 235 (cast iron O.D.)

## DELIVERY, STORAGE, AND HANDLING

PVC pipe shall be delivered, stored, and handled in accordance with the manufacturer's instructions except as required by the plans, special specifications, or as directed by the Engineer.

## INSTALLATION

Installation of PVC pipe shall conform with MAG Section 610 and with the plans and specifications.

## TAPPING

Tapping of PVC pipe shall conform with MAG Sections 610 and 630 and with the plans and specifications.

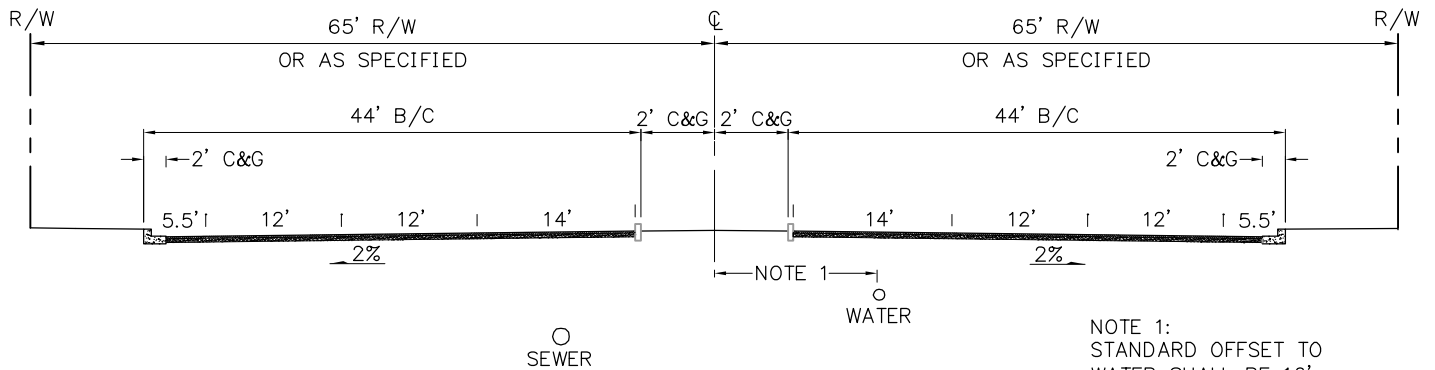
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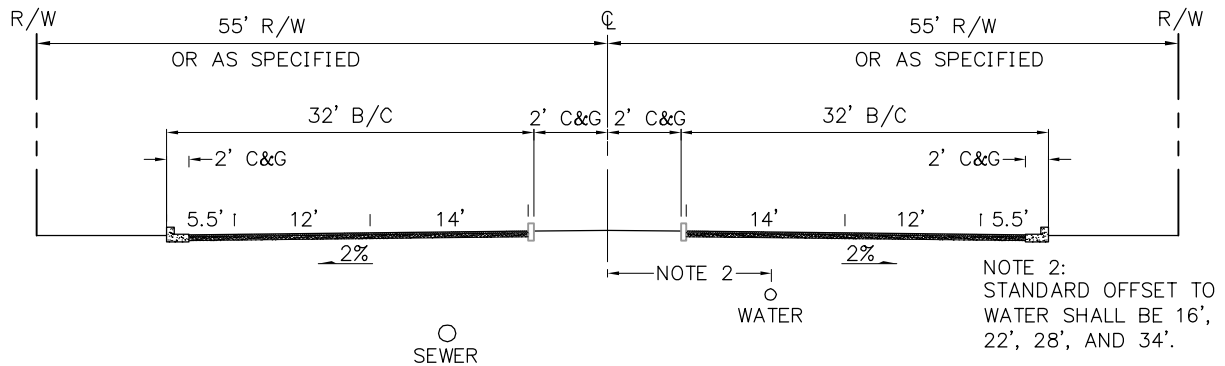
**SWD-1000  
POLYVINYL CHLORIDE PIPE  
(PVC)**



FOR MEANDERING ROADWAY,  
CENTER SANITARY SEWER  
MANHOLES BENEATH LANE 1

### MAJOR ARTERIAL STREET

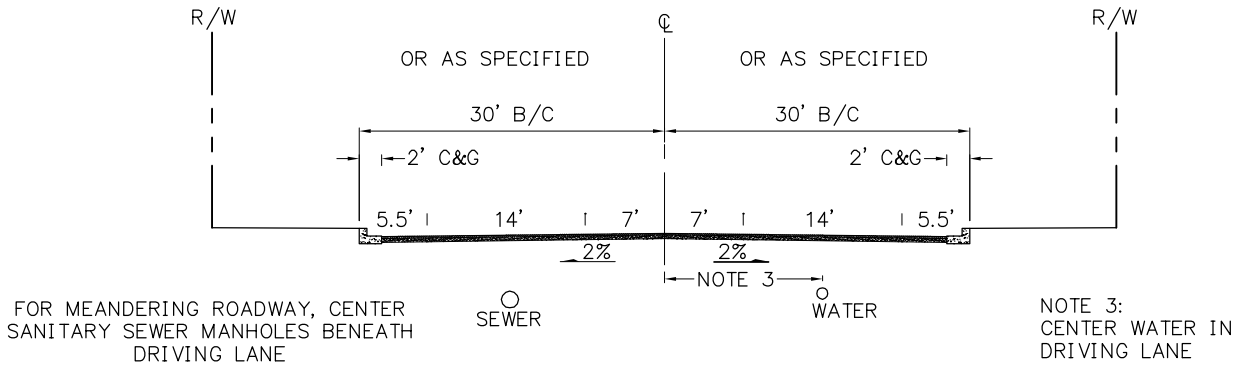
130' RIGHT-OF-WAY N.T.S.



FOR MEANDERING ROADWAY,  
CENTER SANITARY SEWER  
MANHOLES BENEATH LANE 1

### ARTERIAL STREET

110' RIGHT-OF-WAY N.T.S.



FOR MEANDERING ROADWAY, CENTER  
SANITARY SEWER MANHOLES BENEATH  
DRIVING LANE

### COMMERCIAL COLLECTOR

80' RIGHT-OF-WAY N.T.S.

NOTE TYPICAL ALL STREETS AND COLLECTORS:  
NEW WATER LINES TO BE LOCATED TO NORTH OR TO EAST OF RIGHT-OF-WAY CENTER LINE.  
NEW SEWER MAINS TO BE LOCATED TO SOUTH OR TO WEST OF RIGHT-OF-WAY CENTER LINE.

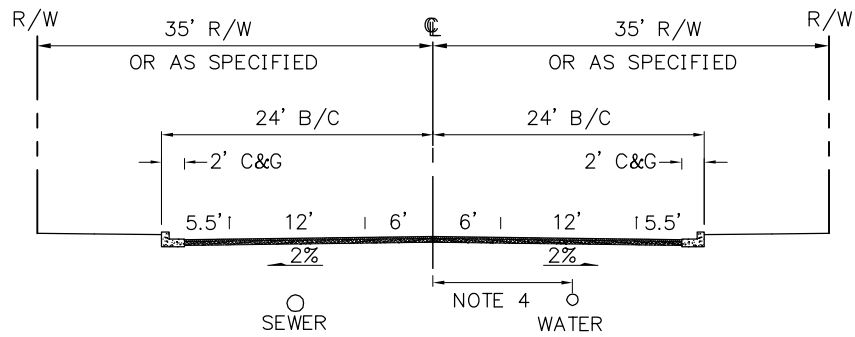
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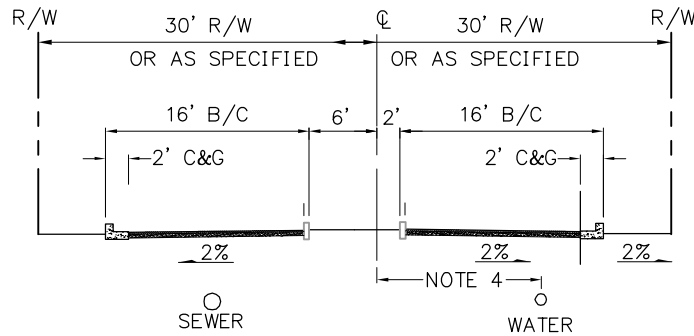
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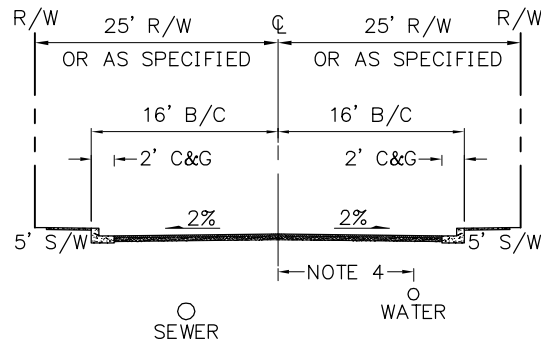
**SWD-1100-1**  
**RIGHT-OF-WAY**  
**PIPE LOCATION**



**COLLECTOR STREET**  
70' RIGHT-OF-WAY N.T.S.



**TYPICAL RESIDENTIAL ENTRANCE**  
60' RIGHT-OF-WAY N.T.S.



**LOCAL STREET**  
50' RIGHT-OF-WAY N.T.S.

TYPICAL STREET SECTIONS THIS SHEET:  
FOR MEANDERING ROADWAY, CENTER  
SANITARY SEWER MANHOLES BENEATH  
DRIVING LANE

NOTE 4:  
CENTER WATER IN  
DRIVING LANE

ISSUED:

MARCH 2007

REVISED:



**SWD-1100-2**  
**RIGHT-OF-WAY**  
**PIPE LOCATION**

**CITY OF ELOY, PUBLIC WORKS DEPARTMENT  
SECTION 9  
STANDARD DETAILS & APPROVED MATERIALS**

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**APPROVED MATERIALS**

The approved materials list contains names of manufactures whose products and materials are approved for use in the City of Eloy water system.

**PIPE**

DIP	GRIFFIN US PIPE PACIFIC STATES / CLOW AMERICAN
PVC	VINYL TEC J.M. CERTAINTEED PACIFIC WESTERN UPONOR DIAMOND
COPPER	TYPE "K" MADE IN USA

**GATE VALVES**

WATEROUS-AFC  
CLOW  
MUELLER  
M&H  
US PIPE  
AVK

**BUTTERFLY VALVES**

M&H  
AMERICAN DARLING  
CLOW  
MUELLER  
PRATT  
DE ZURIK  
KFLOW

**CHECK VALVES**

APCO  
GA INDUSTRIES  
VAL-MATIC  
CRISPIN

**PIPE RESTRAINTS**

CERTAINTEED  
UNI FLANGE  
EBBA IRON 1600 & 1700  
MEGALUG  
MEGA FLANGE  
STAR PIPE PRODUCTS  
PACIFIC STATES  
SIGMA (PV-LOK & ONE-LOK)

**CITY OF ELOY, PUBLIC WORKS DEPARTMENT  
SECTION 9  
STANDARD DETAILS & APPROVED MATERIALS**

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US PIPE (FIELD-LOK)  
PIPELINE COMPONENTS INC.  
REMAC  
GRIFFIN SNAPLOK  
US PIPE TR FLEX  
ONE BOLD

**AIR RELEASE VALVES**

VALMATIC  
GA INDUSTRIES  
ARMSTRONG  
CRISPIN  
APCO  
FLOWMATIC

**DUCTILE IRON FITTINGS**

TYLER  
SIGMA  
STANDARD INTERNATIONAL  
STAR PIPE  
US PIPE  
SOUTHBAY  
UNION FOUNDRY  
GRIFFIN  
NAPCO  
TRINITY VALLEY

**FLEXIBLE COUPLINGS**

CLOW  
VIKING JOHNSON  
POWER SEAL  
SMITH BLAIR  
DRESSER (PRODUCTION FACILITIES ONLY)  
JCM  
FORD  
APAC  
CASCADE  
ROMAC

**REPAIR CLAMPS**

ROMAC  
VCM INDUSTRIES  
CLOW  
POWER SEAL  
SMITH BLAIR  
FORD METER BOX  
APAC PRODUCTS  
JCM  
CASCADE

**CITY OF ELOY, PUBLIC WORKS DEPARTMENT  
SECTION 9  
STANDARD DETAILS & APPROVED MATERIALS**

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**FIRE HYDRANTS**

MUELLER CENTURION

**METER BOXES**

FORD  
LOPEZ  
STAR  
CONTRACTORS ENGINEERS SUPPLY

**MAGNETIC DETECTOR AND MARKING TAPE**

REEF INDUSTRIES  
ALARM TAPE  
PROLINE  
HYTECH  
NORTH TOWN  
LINETEC  
TERRA TAPE

**CORPORATION STOPS, ANGLE METER STOPS, SERVICE SADDLES, U-BRANCHES**

MUELLER  
JONES  
McDONALD